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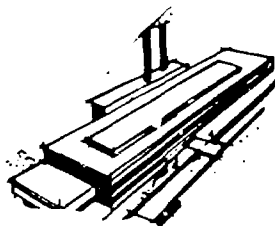
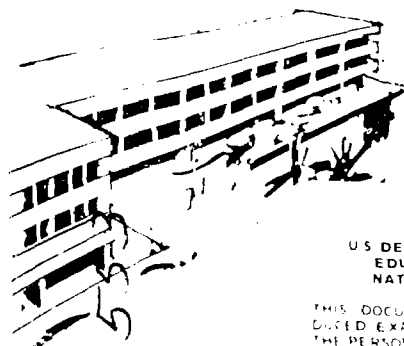
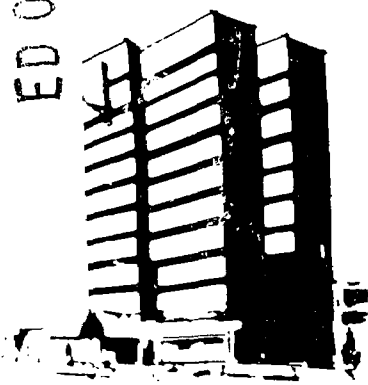
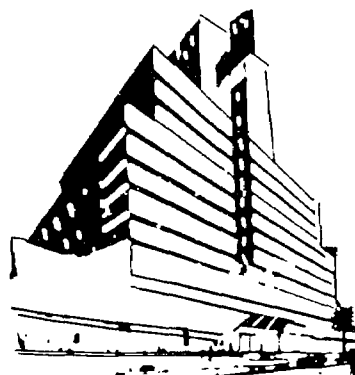
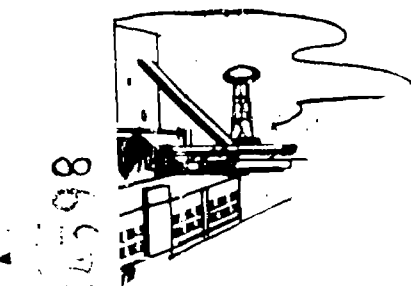
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ABSTRACT

Building maintenance is a basic two-year trade education course requiring 2 1/2 hours of study on each of 160 teaching days per year. Student abilities should range from those capable of the simplest custodial work to those who may eventually be superintendents of building complexes. The syllabus is organized in sections by traditional skills groupings (custodial services, grounds maintenance, redecorating, carpentry, masonry, electricity, plumbing, climate control, drawings and specifications, bookkeeping and estimating). A two-column format lists course content with suggested audiovisuals and methodology. Appended are lists of texts, references, and audiovisuals; a source directory; and a list of tools and equipment considered to be the minimum necessary for a class group of 20 students. (MS)

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BUILDING MAINTENANCE SYLLABUS



THE UNIVERSITY OF THE STATE OF NEW YORK / THE STATE EDUCATION DEPARTMENT
BUREAU OF SECONDARY CURRICULUM DEVELOPMENT / ALBANY, NEW YORK 12224

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TRADE EDUCATION

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BUILDING MAINTENANCE

SYLLABUS

The University of the State of New York/The State Education Department
Bureau of Secondary Curriculum Development/Albany, New York 12224/1973

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FOREWORD

The rapid increase in population, with attendant proliferation of schools, shopping centers, and industrial and residential complexes has created a need for many people skilled in cleaning and maintaining property. Concurrently, the expansion of occupational education allowed a change in emphasis from a few narrow skill areas, available to those whose ability matched requirements of such study, to many broad occupational clusters wherein students of nearly all ability levels can be prepared for employment. *Building Maintenance* exemplifies such a cluster.

In the spring of 1971, teachers of building maintenance courses in selected geographical areas were contacted regarding organization of a syllabus. During that summer Donald Conklin of Rockland BOCES, Richard Jones of Oneida-Madison-Herkimer BOCES, and Edwin Smith of Chemung-Schuyler-Tioga BOCES, met with Charles Stebbins, Associate, Bureau of Trade and Technical Education, and Joseph Messier, Associate in Vocational Curriculum, Bureau of Secondary Curriculum Development, to create a first-draft manuscript. A second draft, incorporating sample performance objectives and expanded teaching suggestions, was prepared by Joseph Fischer of Albany (City) Vocational Center, and Mr. Messier during the summer of 1972, and evaluated by State Education Department personnel and a teacher committee. A final draft, revised to reflect the evaluation, became this syllabus in *Building Maintenance*.

G. Earl Hay, *Supervisor*
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Division of Curriculum Development

TO THE TEACHER

Building Maintenance is a basic 2-year trade education course requiring 2 1/2 hours of study on each of 160 teaching days per year. The broad scope of the subject matter and the multilevel skill structure of subsequent employment, open this course to well-motivated students of nearly all levels of ability. Student abilities should range from those whose employment prospects are the simplest custodial work under close supervision, to those who, with experience and some advanced education, may eventually be superintendents of building complexes — residential, commercial, or industrial — or own a private maintenance contracting business.

The syllabus is organized in sections by traditional skills grouping. This is not a teaching progression. The teacher using the syllabus to write a course of study reflecting local conditions must select content from the syllabus, organizing it in a teaching order which best serves his situation. The suggested time allocations, based on "average-ability," must also be adapted to the particular teaching situation.

A two-column format is used. The first column lists the course content; the second column contains suggested audiovisuals and methodology. Neither column is prescriptive. The teacher is expected to vary the content to fit the abilities and aspirations of each individual student. The teaching suggestions are intended to stimulate the teacher's ingenuity and resourcefulness in tailoring instruction to each individual.

Appended are lists of texts, references, and audiovisuals; a source directory; and a list of tools and equipment considered to be the minimum necessary for a class group of 20 students. A section demonstrating several levels of performance objectives for a selected unit of instruction, as it should appear in a teacher's course of study, begins on page one. This sample should be carefully studied before proceeding to use of the syllabus.

Carl G. Benenati, *Chief*
Bureau of Trade and Technical Education

Robert H. Bielefeld, *Director*
Division of Occupational Education Instruction

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USING THE SYLLABUS

The course content of this syllabus was selected by a committee of experienced teachers as be taught to the student of average abilities — the student who can become proficient in all and in the supervision of other workers. Less talented students should be evaluated on mastery of the content which is within their employment capabilities. More talented students should re administering a maintenance department or service, as well as attaining proficiency in the cour

The teacher of building maintenance could then, be responsible for a class group which will several, or all of the following ability/employability groupings:

Trainable	Closely supervised institutional service.	Basic cleaning of floor glass, and outside area
Educable	Generally supervised industrial, commercial, educational complex service.	The above tasks, plus c simpler machines such a polishers, lawn mowers, throwers, and power swe
Average	Loosely supervised general service, requiring much independent responsibility.	All above, plus invento orders, customer relati some supervision of oth
Talented	General service of a supervisory and administrative or totally independent responsibility.	All above, plus duties apartment or office bui superintendent and of 1 superintendent of a bui

USING THE SYLLABUS

Content of this syllabus was selected by a committee of experienced teachers as that which should be suitable for a student of average abilities — the student who can become proficient in all maintenance duties, equal to those of other workers. Less talented students should be evaluated on mastery of only that part of the syllabus which is within their employment capabilities. More talented students should receive instruction in all maintenance department or service, as well as attaining proficiency in the course content.

Building maintenance could then, be responsible for a class group which will contain one, or more, of the following ability/employability groupings:

Closely supervised institutional service.

Basic cleaning of floors, walls, glass, and outside areas.

Generally supervised industrial, commercial, educational complex service.

The above tasks, plus operation of simpler machines such as floor polishers, lawn mowers, snow throwers, and power sweepers.

Loosely supervised general service, requiring much independent responsibility.

All above, plus inventory, purchase orders, customer relations, and some supervision of other workers.

General service of a supervisory and administrative or totally independent responsibility.

All above, plus duties of the apartment or office building superintendent and of the assistant superintendent of a building complex.

It must be clearly understood that these terms and descriptions are broad generalizations for convenience in instructional organization, since *no individual can be exactly and irrevocably evaluated*. The primary duty of the teacher of building maintenance is to evaluate pupil personnel tests and measurements in light of his own industrial experience, to determine the *probable* employment capabilities of each student, then to develop an individualized program of instruction calculated to bring the student to his maximum achievement.

Successful completion of this course must then, be based on projected employability at the demonstrated level of ability, rather than on mastery of any fixed percentage of the total course.

After familiarizing himself with the contents of this syllabus, the teacher should begin organization of study which, using the syllabus as a base, reflects the teaching conditions and employment situation of the geographic area. The first task may be to reorganize the content into a tentative teaching program. The first section of the syllabus is "Grounds Maintenance," but the teacher may prefer to begin instruction with "Custodial Services." Likewise, the syllabus places "Floors" as Unit I of "Custodial Services" but the teacher may find it more logical to teach "Painting" as the initial unit since these operations would be first in a job sequence where an entire room is to be painted. After the teacher completes a tentative sequence of instruction his next task is to set limits of breadth and depth of instruction in each unit of content, thus defining exactly what the student should know and what skills he should possess as a result of the instruction. Considering the variety of student ability level inherent in building maintenance, the teacher of this course should find *performance objectives* of inestimable value.

In industry, the competent worker given an apprentice or new employee to instruct, judges the progress of the learner and the effectiveness of his instruction by whether or not the learner, on his own, can perform the particular task.

be understood that these terms and descriptions are broad generalizations intended for national organization, since *no individual can be exactly and irrevocably categorized*. It is the teacher of building maintenance to evaluate pupil personnel tests and measurements in practical experience, to determine the *probable* employment capabilities of each individual, and individualized program of instruction calculated to bring the student to his highest level of

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ing himself with the contents of this syllabus, the teacher should begin organizing a course the syllabus as a base, reflects the teaching conditions and employment situation in his first task may be to reorganize the content into a tentative teaching progression. The syllabus is "Grounds Maintenance," but the teacher may prefer to begin instruction with Likewise, the syllabus places "Floors" as Unit I of "Custodial Services" due to simplicity of performance. The teacher can, if he desires, teach "Unit II — Wall and Ceiling" as the first operation would be first in a job sequence where an entire room is to be cleaned. When a tentative sequence of instruction his next task is to set limits of breadth and depth of unit of content, thus defining exactly what the student should know and what new skills he result of the instruction. Considering the variety of student ability levels and employment building maintenance, the teacher of this course should find *performance objectives* to be of

competent worker given an apprentice or new employee to instruct, judges both the development effectiveness of his instruction by whether or not the learner, on his own, can actually task.

In teaching building maintenance, the industrially experienced instructor will instinctively use performance criteria in evaluating student progress. He should also use it as a means of selecting successful teaching methods. The teacher should then, write performance objectives *before* developing plans which state *how* he intends to teach. An added benefit of performance objectives is that they not only clearly define the instruction but also constitute a test of the effectiveness of the instruction. While writing performance objectives for use by others requires some particular language ability, one's own use is quite simple.

Performance objectives must always be stated in terms of the student, never in terms of the teacher. Performance objectives must require *demonstration* of ability rather than an assumption that the student can do it. They say that the student performs the skill, or describes the performance. Never do they say that the student "understands," or the student "appreciates." Performance objectives always will state 1) what the student can demonstrably do, 2) to what level of proficiency he must perform, and 3) under what conditions he will perform. For example, the unit of instruction may be the mixing of the cleaning agent for mopping floors. To state that "The student will understand how to mix liquid detergents and water in proper proportions for mopping floors," is not a performance objective and is not of much use in determining instructional effectiveness. A performance objective for this task, written for three levels of ability

Average and Talented

Given a custodial chart which requires mopping of a vinyl floor, and given access to pertinent materials and equipment, the student will (or describe, orally or in writing) the proper container and prepare (or describe preparation of) the proper water/detergent mixture in correct sequence. No errors allowable.

Educable

Given the proper materials and equipment the student will mix the water and water in correct sequence, to within 10 percent of proper proportions on a minimum of 9 out of 10 attempts.

Among the instructional methods following the objectives might be 1) opaque projection (name and instructions) of all detergents commonly used for the purpose, or overhead projection

building maintenance, the industrially experienced instructor will instinctively use the same criteria in evaluating student progress. He should also use it as a means of selecting probably good teaching methods. The teacher should then, write performance objectives *before* developing lesson plans, *how* he intends to teach. An added benefit of performance objectives is that, properly stated, they clearly define the instruction but also constitute a test of the effectiveness of the instruction. Writing performance objectives for use by others requires some particular language ability, writing for which is quite simple.

Performance objectives must always be stated in terms of the student, never in terms of the teacher. Objectives must require *demonstration* of ability rather than an assumption that it exists, therefore, the student performs the skill, or describes the performance. Never do they state merely that the student "understands," or the student "appreciates." Performance objectives always will state 1) what the student is to do, 2) to what level of proficiency he must perform, and 3) under what conditions he must perform. For example, the unit of instruction may be the mixing of the cleaning agent for mopping floors. To state that the student will understand how to mix liquid detergents and water in proper proportions for mopping is a performance objective and is not of much use in determining instructional methods or criteria. A performance objective for this task, written for three levels of ability might be:

Level 1 and
Level 2
Given a custodial chart which requires mopping of a vinyl floor, and given access to pertinent materials and equipment, the student will select (or describe, orally or in writing) the proper container and detergent and prepare (or describe preparation of) the proper water/detergent mixture in correct sequence. No errors allowable.

Level 3
Given the proper materials and equipment the student will mix detergent and water in correct sequence, to within 10 percent of proper proportion, on a minimum of 9 out of 10 attempts.

Instructional methods following the objectives might be 1) opaque projection of labels (brand names and directions) of all detergents commonly used for the purpose, or overhead projection of facsimile trans-

parencies; 2) distribution of job instruction sheet; 3) teacher demonstration; 4) any combination of these. The column of suggestions, and the appended Resource Lists may be helpful here.

Evaluation of this instruction may be by observation of student performance during the course of student behavior during a scheduled performance test, and by evaluation of student answers to a performance test requires only that the performance objective be reworded as a job instruction. An oral quiz is constructed by rephrasing the objective as questions. The teacher who constructs his quiz on a basis of student performance, and phrases his desired teaching outcomes as performance objectives, have, at the same time, constructed an outline for evaluating the success of the course and of the student.

All course objectives need not be stated in performance terms, however. Performance objectives are easily written for the psychomotor domain of skill development and the cognitive domain of occupation. It is more difficult to write complete performance objectives in the affective domain areas of student attitude for evaluation of student attitudes remains a function of the teacher's judgement. When evaluating "appreciation" the teacher should *think* in terms of performance objectives, but should not become precise writing.

Unit I — FLOORS, of the CUSTODIAL SERVICES section, is offered as one example of how the study should be developed from this syllabus.

UNIT I — FLOORS

PERFORMANCE OBJECTIVES

- o Materials
 - Wood
 - Masonry
 - . Concrete
 - . Brick
 - . Ceramic
 - . Stone
 - Composition
 - Carpeting

The student should be able to:
Identify the material composing each of a representative group of teacher-supplied samples of standard floor materials.

Describe the principal characteristics of each floor material.

Motivatio
problem h

ution of job instruction sheet; 3) teacher demonstration; 4) any combination of these.
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S, of the CUSTODIAL SERVICES section, is offered as one example of how the teacher's course of
oped from this syllabus.

PERFORMANCE OBJECTIVES

NOTES

The student should be able to:
Identify the material composing each of a
representative group of teacher-supplied
samples of standard floor materials.

Describe the principal characteristics of
each floor material.

Motivation is the crucial
problem here.

- o Maintenance
 - Frequency
 - . Daily
 - . Periodic
 - Processes
 - . Cleaning
 - . Stripping
 - . Sealing
 - . Waxing
 - Equipment
 - . Vacuums
 - . Scrubbers
 - . Polishers
- o Repair
 - Staff work
 - Contracted service

The student should be able to:

Demonstrate ability to perform duties in sequence outlined on custodial charts, performance meeting field standards of acceptability.

Demonstrate ability to interpret chart information regarding procedures, equipment, and materials to be used.

Demonstrate ability to operate floor maintenance equipment, conforming to field standards of safety and competency.

Recognize the limits of minor repairs to be performed by custodial staff.

Demonstrate an ability to perform minor repairs to standard floor materials.

Title job as
mechanic" of
rather than

Use power e
feasible.

Limits woul
as well as
particular

Having written a course of study organized in this manner, the teacher can more easily of instruction — both group and individual — which will be more effective, evaluate the and modify the instruction where effectiveness can be improved.

The student should be able to:

Demonstrate ability to perform duties in sequence outlined on custodial charts, performance meeting field standards of acceptability.

Demonstrate ability to interpret chart information regarding procedures, equipment, and materials to be used.

Demonstrate ability to operate floor maintenance equipment, conforming to field standards of safety and competency.

Recognize the limits of minor repairs to be performed by custodial staff.

Demonstrate an ability to perform minor repairs to standard floor materials.

Title job as "custodial mechanic" or similar term, rather than janitor.

Use power equipment wherever feasible.

Limits would be set by size as well as abilities of the particular staff.

g written a course of study organized in this manner, the teacher can more easily plan units
tion — both group and individual — which will be more effective, evaluate the effectiveness,
y the instruction where effectiveness can be improved.

CUSTODIAL SERVICES

Suggested Time: 120 Hours

UNIT I — FLOORS

TEACHING SUGGESTIONS

- Materials
 - Wood
 - Masonry
 - . Concrete
 - . Brick
 - . Ceramic
 - . Stone
 - Composition
 - . Linoleum
 - . Vinyl
 - . Vinyl-Asbestos
 - . Asphalt
 - Carpeting
 - . Wool
 - . Synthetics
- Maintenance
 - Frequency
 - . Daily
 - . Periodic
 - Processes
 - . Cleaning
 - . Stripping
 - . Sealing
 - . Waxing
 - Equipment
 - . Vacuums
 - . Scrubbers
 - . Polishers
- Repair
 - Staff work
 - Contract

Use of actual floors or reasonably large mock-ups is more effective than small samples of materials.

The custodial chart should be used wherever student ability allows.

Emphasize need to provide for safety of traffic through work area.

Standards of competency should vary both with the ability of the student and requirements of possible job openings.

The point where minor repairs become major differs with the size and nature of the maintenance staff. The teacher should set a realistic cut-off point.

UNIT II — WALL AND CEILING

- Surfaces
 - Wall
 - . Ceramic
 - . Glass
 - . Vinyl
 - . Melamine
 - . Applied finish
 - Paints
 - Lacquers
 - Varnishes
 - Sealers
 - Ceiling
 - . Acoustic tile
 - Vegetable fiber
 - Asbestos
 - . Glass fiber panel
 - . Applied finish
 - Maintenance
 - . Custodial chart

The student should be able to distinguish applied surfaces and those which are part of the structure.

Emphasize the necessity of removing, preparing, and reconditioning floors, window sills, radiators, and similar areas.

Instruction in cleaning exterior glass and floor level requires particular teacher attention for safety and supervision.

Instruction should include the damage which can result from use of improper materials or methods in cleaning materials, as well as practice in use of proper materials and methods.

Proper erection of scaffolding and use of safety equipment of extreme importance.

UNIT III — WINDOWS

- Design
 - Double hung
 - Casement
 - Vent
 - . Awning
 - . Hopper
 - Sliding
- Materials
 - Wood
 - Aluminum

It is not necessary that all students be able to identify window types by name, but if of safety, all students must:

Demonstrate ability to identify movable and fixed lights.

Demonstrate ability to unlatch, open, and relatch each type of movable sash.

Removal, handling, storage, and reinstallation of removable double glazing must be taught.

— WALL AND CEILING

Surfaces
Wall
 Ceramic
 Glass
 Vinyl
 Melamine
 Applied finish
 Paints
 Lacquers
 Varnishes
 Sealers
Ceiling
 Acoustic tile
 Vegetable fiber
 Asbestos
 Glass fiber panel
 Applied finish
Maintenance
 Custodial chart

The student should be able to distinguish between applied surfaces and those which are part of the structure.

Emphasize the necessity of removing, protecting, or reconditioning floors, window sills, radiators, and similar areas.

Instruction in cleaning exterior glass above ground-floor level requires particular teacher attention to safety and supervision.

Instruction should include the damage which can result from use of improper materials or methods on particular materials, as well as practice in use of proper material and methods.

Proper erection of scaffolding and use of ladders is of extreme importance.

— WINDOWS

Design
Double hung
Casement
Vent
 Awning
 Hopper
Sliding

It is not necessary that all students be able to identify window types by name, but if only for purposes of safety, all students must:

Demonstrate ability to identify movable sash and fixed lights.

Demonstrate ability to unlatch, open, close, and relatch each type of movable sash.

Materials
Wood
Aluminum

Removal, handling, storage, and reinstallation of removable double glazing must be taught.

- Glass
 - . Strength
 - . Style
 - Transparent
 - Translucent
 - Tinted
 - Ribbed

The student should know the system of glass and the types of safety glass. a broad understanding of the character and standard uses of each.

- o Mechanism
 - Operator
 - . Manual
 - . Rotary
 - Latch
 - . Cam
 - . Bolt
- o RDG
- o Weatherstripping
- o Maintenance
 - Process
 - . Cleaning
 - . Lubricating
 - Frequency
 - . Daily
 - . Periodic

Emphasize the importance of keeping the door and slots clean, free of debris, and lubricated.

UNIT IV — SANITARY FACILITIES

- o Major fixtures
 - Service
 - . Lavatories
 - . Showers
 - . Urinals and closets
 - . Mirrors

Several types, in several materials, should be available for student inspection and practice. Use of graphic representations is allowed.

CUSTODIAL

- Glass
 - . Strength
 - . Style
 - Transparent
 - Translucent
 - Tinted
 - Ribbed

The student should know the system of "strengths" of glass and the types of safety glass. He should have a broad understanding of the characteristics and standard uses of each.

- Mechanism
 - Operator
 - . Manual
 - . Rotary
 - Latch
 - . Cam
 - . Bolt

RDG

Weatherstripping

- Maintenance
 - Process
 - . Cleaning
 - . Lubricating
 - Frequency
 - . Daily
 - . Periodic

Emphasize the importance of keeping mechanisms, tracks, and slots clean, free of debris, and where required, lubricated.

IV — SANITARY FACILITIES

- Major fixtures
- Service
 - . Lavatories
 - . Showers
 - . Urinals and closets
 - . Mirrors

Several types, in several materials, should be available for student inspection and practice, but some use of graphic representations is allowable.

- Materials
 - . Vitreous china
 - . Porcelained Steel
 - . Cast iron
 - . Stainless steel
 - . Bright plated
 - . Glass

- o Dispensers
 - Paper
 - . Towels
 - . Tissue
 - Warm air
 - Soap
 - Disinfectants
 - Deodorizers
 - Sanitary napkins

- o Maintenance
 - Cleaning
 - . Daily
 - . Periodic
 - Resupplying

Job status can be a real problem in the classroom. The teacher should give much thought to motivating the students. A good starting point is to remind them that their mothers perform similar jobs at home and are not considered "degraded."

Use of the custodial chart is very valuable.

UNIT V — FURNISHINGS

- o Service
 - Office
 - . Desks
 - . Chairs
 - . Tables
 - . Cabinets
 - File
 - Supply

The habit of continual use of the custodial chart should be developed.

The student should also acquire judgment as to which furnishings are moved to facilitate cleaning and which are moved only for periodic redecorating; which should be moved only when necessary; which should require equipment; and which should be selected for moving particular items.

Materials
Vitreous china
Porcelained
Steel
Cast iron
Stainless steel
Bright plated
Glass

Dispensers
Paper
Towels
Tissue
Warm air
Soap
Disinfectants
Deodorizers
Sanitary napkins

Maintenance
Cleaning
Daily
Periodic
Resupplying

— FURNISHINGS

Service
Office
Desks
Chairs
Tables
Cabinets
File
Supply

Job status can be a real problem in this area. The teacher should give much thought to means of accomplishing motivation. A good starting point may be to remind that their mothers perform these services at home and are not considered "degraded."

Use of the custodial chart is very valuable here.

The habit of continual use of the custodial chart must be developed.

The student should also acquire judgment as to which furnishings are moved to facilitate routine cleaning, and which are moved only for periodic cleaning or redecorating; which should be moved manually, and which should require equipment; and which piece of equipment should be selected for moving particular furnishings.

- Lounge
 - Couches
 - Chairs
 - Tables
 - Book racks
- General
 - Lamps
 - Folding partitions
 - Venetian blinds
 - Curtains
 - Draperies
 - Chalk boards
 - Bulletin boards
 - Coat racks
- Maintenance
 - Moving
 - Storing
 - Cleaning
 - Repairing

The course equipment should include a sample of carts, dollies, and handtrucks.

It is extremely important that all students learn the "body mechanics" of proper lifting and carrying.

UNIT VI — SPECIAL AREAS

- Service
 - Auditorium
 - Gymnasium
 - Stadium
 - Cafeteria
 - Athletic field
 - Conference room

The student should be aware of the part involved in maintenance of each area, and the procedures to be used. Field trips to these areas before, during, and immediately after school are valuable.

A good method is to effect a cooperation with school custodial staffs which will include live work at school facilities.

CUSTODIAL

- Lounge
- Couches
- Chairs
- Tables
- Book racks

- General
- Lamps
- Folding partitions
- Venetian blinds
- Curtains
- Draperies
- Chalk boards
- Bulletin boards
- Coat racks

- Maintenance
- Moving
- Storing
- Cleaning
- Repairing

The course equipment should include a representative sample of carts, dollies, and handtrucks.

It is extremely important that all students be taught the "body mechanics" of proper lifting, pushing, and carrying.

VI — SPECIAL AREAS

- Service
- Auditorium
- Gymnasium
- Stadium
- Cafeteria
- Athletic field
- Conference room

The student should be aware of the particular problems involved in maintenance of each area, as well as the procedures to be used. Field trips to these areas before, during, and immediately after use should be valuable.

A good method is to effect a cooperative arrangement with school custodial staffs which will allow students live work at school facilities.

- o Procedures
 - Preparatory
 - . Cleaning
 - . Setting up
 - Maintaining set up
 - Follow up
 - . Removing temporaries
 - . Storing temporaries
 - . Cleaning

UNIT VII — SUPPLIES AND EQUIPMENT

- o Equipment
 - Tools
 - . Hand
 - . Power
 - Equipment maintenance
 - . Cleaning
 - . Lubricating
 - . Repairing
 - Applicators
 - . Brushes
 - . Cloths
 - . Sponges
 - Storage units

The student must, of course, know proper use of tools and equipment. He should be able to select proper items from stock, for the job to be done. The teacher should emphasize the effects of misuse of tools, equipment, and materials, and conversely, of working with worn out, or improper materials.

The student's apparent ability should be judged in terms of equipment maintenance knowledge and responsibility which he should be accountable.

- o Supplies
 - Cleaning agents
 - . Caustic
 - . Abrasive
 - . Detergent
 - . Neutral
 - Waxes and polishes
 - Disinfectants
 - Deodorant
 - Dispenser supplies
 - Gasoline, oil, and grease

The student should be conditioned to read the label of each new container, and follow directions exactly.

Not only should the student be aware of the dangers of obviously dangerous materials, he should be aware of how harmful and hazardous substances can be created by mixing cleaning agents.

cedures
reparatory
Cleaning
Setting up
maintaining set up
ollow up
Removing temporaries
Storing temporaries
Cleaning

— SUPPLIES AND EQUIPMENT

quipment
ools
Hand
Power
quipment maintenance
Cleaning
Lubricating
Repairing
pplicators
Brushes
Cloths
Sponges
torage units

The student must, of course, know proper names of tools and equipment. He should be able to select the commoner items from stock, for the job to be done. The teacher should emphasize the effects on profits of waste and abuse of tools, equipment, and supplies, and conversely, of working with worn out, defective, or improper materials.

The student's apparent ability should indicate the extent of equipment maintenance knowledge and skills for which he should be accountable.

pplies
leaning agents
Caustic
Abrasive
Detergent
Neutral
axes and polishes
Disinfectants
Deodorant
Dispenser supplies
Gasoline, oil, and
grease

The student should be conditioned to carefully read the label of each new container, and follow directions exactly.

Not only should the student be aware of the more evidently dangerous materials, he should also know that harmful and hazardous substances can sometimes be created by mixing cleaning agents.

UNIT VIII — SAFETY

- Property damage
 - Utility lines
 - . Gas
 - . Electricity
 - . Water
 - Storage
 - . Combustibles
 - . Spoilables
 - Equipment operation
 - . Glass breakage
 - . Structure damage
 - . Landscape damage
 - Fires
 - . Prevention
 - . Classification
 - . Extinguishing
- Personal injury
 - Cuts and punctures
 - . Equipment-caused
 - . Materials-caused
 - Glass
 - Metals
 - Plastics
 - Burns
 - . Thermal
 - . Chemical
 - . Electrical
 - Shock
 - . Electrical
 - Equipment
 - Supply lines
 - . Impact
 - Personal falls
 - Falling objects

Safety — both personal and public — and property protection should be an inherent part of all instruction. It is separately categorized here only for convenience of presentation.

The student should be taught what he *must not* do, as well as proper procedures, and should understand *why* he should or *must not*.

It is especially important that building maintenance personnel knows the classification of fires, the proper extinguishers for each, and the dangers of using the wrong type.

The student must be made aware of the injury potential of common tools, equipment, and materials.

- Asphyxia
 - . Smoke
 - . Gas
 - . Oxygen deficiency
- Emergency procedures
 - . Securing help
 - . Preventing further injury
 - . First aid
 - Limits
 - Procedures

It is desirable that the student receive instruction in basic first-aid. It is mandatory that he receive instruction in emergency procedures.

UNIT IX — HUMAN RELATIONS

- Interstaff
 - Fellow workers
 - Superiors
 - Subordinates
- Nonstaff
 - Visitors
 - Occupants

The teacher should emphasize the importance of tolerance and courtesy; that far more employees are discharged because they antagonize other people, than because they do not perform the work.

GROUNDS MAINTENANCE

Suggested Time: 50 Hours

UNIT I — ROADS, WALKS, PARKING AREAS

TEACHING SUGGESTIONS

- Cleaning

- Sweeping
 - Hand
 - Power
- Washing
- Sealing

The student should be capable of selecting sweeping equipment for a given job, as well as of using it.

The teacher should emphasize *why* these surfaces as well as how to do so.

- Weather problems

- Snow removal
- Ice removal
- Drainage

The student should be acquainted with the problems which result from improper maintenance: flooding and runoff from plowed-in drains, disruptions due to covered signs and markings.

- Traffic flow

- Signs
- Markings
- Lighting
- Barricades

Instruction should include testing and repair of photoelectric and timed lighting controls.

UNIT II — LANDSCAPE

- Type

- Lawns
- Shrubbery
- Flowers
- Trees

The student should be able to demonstrate selected means, an ability to classify any as tree or shrub; grass, flower, or weed.

GROUNDS MAINTENANCE

Suggested Time: 50 Hours

— ROADS, WALKS, PARKING AREAS

TEACHING SUGGESTIONS

Cleaning
Sweeping
 . Hand
 . Power
Washing
Sealing

The student should be capable of selecting the proper sweeping equipment for a given job, as well as capable of using it.

The teacher should emphasize *why* these surfaces are sealed, as well as how to do so.

Weather problems
 Snow removal
 Ice removal
 Drainage

The student should be acquainted with the less evident problems which result from improper maintenance, such as flooding and runoff from plowed-in drains, and traffic disruptions due to covered signs and markings.

Traffic flow
 Signs
 Markings
 Lighting
 Barricades

Instruction should include testing and replacement of photoelectric and timed lighting controls.

II — LANDSCAPE

Type
 Lawns
 Shrubbery
 Flowers
 Trees

The student should be able to demonstrate by any teacher selected means, an ability to classify any common sample as tree or shrub; grass, flower, or weed.

- Cultivation
 - Watering
 - Fertilizing
 - Mulching
 - Mowing and pruning
 - Debris removing
 - . Leaves and cuttings
 - . Litter
- Protection
 - Insecticides
 - Fungicides
 - Herbicides
 - Seasonal preparation

The ability to use a procedural chart and manuals to determine maintenance of existing should be developed.

Emphasize the hazardous nature of all insecticides, fungicides, and herbicides, and of some the need to obey instructions exactly.

UNIT III — EQUIPMENT

- Snow blowers
 - Single stage
 - Two stage
- Lawn mowers
 - Type
 - . Rotary
 - . Reel
 - Drive
 - . Manual
 - . Self-propelled
 - Walking
 - Riding
- Lawn cleaners
 - Type
 - . Sweeper
 - . Vacuum
 - Drive
 - . Manual
 - . Trailer
 - . Self-propelled

The operating of power equipment can be a limiting factor.

While power equipment is generally more expensive than hand tools, its use in the field is common. All students should be instructed in the proper functioning, the potential hazards and safety and practical field operation of all common equipment. All students should be provided opportunity to demonstrate competence under close supervision. The teacher will, of course, exercise judgment in regard to loosely supervised operation for particular students.

irrigation
watering
fertilizing
mulching
mowing and pruning
debris removing
leaves and cuttings
litter

The ability to use a procedural chart and horticultural manuals to determine maintenance of existing landscape should be developed.

protection
insecticides
fungicides
herbicides
seasonal preparation

Emphasize the hazardous nature of all insecticides, fungicides, and herbicides, and of some fertilizers, and the need to obey instructions exactly.

— EQUIPMENT

blow blowers
single stage
two stage

The operating of power equipment can be a powerful motivating factor.

lawn mowers
type
Rotary
Reel
drive
Manual
Self-propelled
Walking
Riding

While power equipment is generally more dangerous than hand tools, its use in the field is constantly increasing. All students should be instructed in the functions and functioning, the potential hazards and safe procedure, and practical field operation of all currently used power equipment. All students should be provided the opportunity to demonstrate competence under close teacher supervision. The teacher will, of course, exercise his judgment in regard to loosely supervised operation by particular students.

lawn cleaners
type
Sweeper
Vacuum
drive
Manual
Trailer
Self-propelled

- Function
 - Operation
 - Maintenance
- Watering systems
 - Underground
 - Self-propelled
 - Manually placed
- Feeding and protecting systems
 - Liquid sprayers
 - Power spreaders
 - Granule spreaders

Competence in routine cleaning and lubrication directed by manufacturers' literature, should be a prerequisite to the student being listed as competent who the teacher will assign to operating.

The maintenance, adjustment, and minor repairs of valves, timers, lines, and other parts of the system should be taught, as well as the safe and

1 GROUNDS

Competence in routine cleaning and lubricating, as directed by manufacturers' literature, should be a prerequisite to the student being listed with those who the teacher will assign to operating power equipment.

The maintenance, adjustment, and minor repair of valves, timers, lines, and other parts of these systems should be taught, as well as the safe and efficient use.

ction
operation
aintenance

tering systems
nderground
elf-propelled
anually placed

eding and protecting systems
iquid sprayers
ower spreaders
ranule spreaders

REDECORATING

Suggested Time: 55 Hours

UNIT — SURFACE PREPARATION

TEACHING SUGGESTIONS

- Cleaning
 - Washing
 - . Detergents
 - . Solvents
 - Stripping
 - . Abrasives
 - Hand
 - Power
 - . Heat
 - . Chemicals
 - . Scrapers
- Patching
 - Surface
 - . Masonry
 - . Wood
 - . Metal
 - . Plastic
 - Materials
 - . Putty
 - . Wood doughs
 - . Spackle
 - . Dry wall cement
 - . Mortar
 - . Epoxy fillers
 - . Stick shellac
- Smoothing
 - Tools
 - . Planes
 - Hand
 - Power
 - . Rasps and files
 - . Scrapers
 - . Surforms

The student must be made aware of the critical importance of properly preparing the surface before refinishing.

Emphasize that some surfaces need only be cleaned of deposits, some may require roughening or sanding, and some may require removal of previously applied material.

The student should be instructed in the proper use of stripping materials and equipment.

The student should be assisted in developing knowledge of the physical properties of various materials and respective patching materials.

The student should be able to demonstrate the ability to select materials, equipment, and procedures to perform the operations necessary to patch the surface of quality, any teacher-designated surface.

Dry wall joint system application must be understood. Whether it is considered the domain of the mason, or the carpenter differs with local custom and nonunion status of the workers.

Instruction should include an explanation of how the tools function.

The student should be able to perform routine use of tools, including sharpening of those that are honed in the field.

REDECORATING

Suggested Time: 55 Hours

— SURFACE PREPARATION

TEACHING SUGGESTIONS

- Cleaning
 - Washing
 - . Detergents
 - . Solvents
 - Stripping
 - . Abrasives
 - Hand
 - Power
 - . Heat
 - . Chemicals
 - . Scrapers

The student must be made aware of the critical importance of properly preparing the surface to be refinished.

Emphasize that some surfaces need only be washed clean of deposits, some may require roughening or smoothing, and some may require removal of previously applied finishes.

The student should be instructed in the safe use of stripping materials and equipment.

- Patching
 - Surface
 - . Masonry
 - . Wood
 - . Metal
 - . Plastic
 - Materials
 - . Putty
 - . Wood doughs
 - . Spackle
 - . Dry wall cement
 - . Mortar
 - . Epoxy fillers
 - . Stick shellac

The student should be assisted in developing a general knowledge of the physical properties of common building materials and respective patching materials.

The student should be able to demonstrate an ability to select materials, equipment, and procedure, and to perform the operations necessary to patch to field standards of quality, any teacher-designated surface.

Dry wall joint system application must be taught. Whether it is considered the domain of the painter, the mason, or the carpenter differs with locality and union/nonunion status of the workers.

- Smoothing
 - Tools
 - . Planes
 - Hand
 - Power
 - . Rasps and files
 - . Scrapers
 - . Surforms

Instruction should include an explanation of how the tools function.

The student should be able to perform routine maintenance of tools, including sharpening of those commonly ground or honed in the field.

- Sanders
 - Belt
 - Disc
 - Orbital
 - Reciprocating
- Abrasives
 - . Type
 - . Shape
 - . Grade
- o Staining
 - Types
 - . Oil
 - . Water
 - . Spirit
 - Properties

Emphasize that a good finish cannot be at a poorly prepared surface.

The student should know the system of identification, composition, grit size, backing, and other characteristics of coated abrasives, well enough to properly select stock for any particular smoothing operation.

The student should know the strengths, weaknesses, and probable side effects of the different stains, as being proficient in their use.

UNIT II — FINISHES

- o Types
 - Clear
 - . Varnish
 - . Shellac
 - . Lacquer
 - . Synthetic resins
 - . Sealers
 - Paint
 - . Base
 - Oil
 - Water emulsion
 - . Use
 - Primer
 - Finish coat
 - . Surface finish
 - Flat
 - Semigloss
 - Gloss
 - Textured

Instruction should include the strengths and weaknesses of the various finishes, use of solvents and conditions during and after application to avoid damage to the finish.

It is important that the student be able to select the proper finish as either oil-base or water-base, and the application method provided on the label.

The student should be instructed in the characteristics, or undesirability, of certain characteristics such as resistance, easy washability, high reflectance, and so on, to govern selection for particular uses.

REDECORATING

Sanders
 Belt
 Disc
 Orbital
 Reciprocating
Abrasives
 Type
 Shape
 Grade
Staining
 Types
 Oil
 Water
 Spirit
Properties

Emphasize that a good finish cannot be attained on a poorly prepared surface.

The student should know the system of identifying grit composition, grit size, backing, and other characteristics of coated abrasives, well enough to properly select from stock for any particular smoothing operations.

The student should know the strengths, weaknesses, and probable side effects of the different stains, as well as being proficient in their use.

— FINISHES

Types
 Clear
 Varnish
 Shellac
 Lacquer
 Synthetic resins
 Sealers
 Paint
 Base
 Oil
 Water emulsion
 Use
 Primer
 Finish coat
 Surface finish
 Flat
 Semigloss
 Gloss
 Special

Instruction should include the strengths and weaknesses of the various finishes, use of solvents and thinners, and conditions during and after application which might damage the finish.

It is important that the student be able to identify a finish as either oil-base or water-base, through information provided on the label.

The student should be instructed in the desirability, or undesirability, of certain characteristics — soil resistance, easy washability, high reflectivity — which govern selection for particular uses.

- o Service
 - Interior
 - Exterior
- o Solvents
 - Mineral spirits
 - Turpentine
 - Lacquer thinner
 - Alcohol
 - Other

Emphasize that while the use of interior is merely uneconomical, the use of lead-based paints indoors can be injurious to health.

The student should be aware of the importance of the correct solvent.

Instruction should include such possible as destruction of particular plastics and of vapors.

Emphasize skin and eye protection as well as inhalation and ingestion.

- o Application
 - Brush
 - . Types
 - . Sizes
 - . Materials
 - Roller
 - . Types
 - Pan
 - Pressure
 - . Materials
 - Mohair
 - Lamb's wool
 - Spray
 - . Suction
 - . Pressure

Strive to develop students' judgment in type and size, and bristle material. They should know when it is more efficient to use a brush which is on hand, than to delay to get the "correct" brush.

Emphasize the importance of using the type of brush which is required for the type of paint to be used.

Instruction should include a comparison of the advantages and disadvantages of the two methods.

The student should be able to demonstrate the proper use of clean brushes, rollers, and spray equipment and standards of acceptability.

UNIT III — WALL COVERINGS

- o Roll materials
 - Paper
 - Fabric
 - Plastic

The student should be able to identify the various wall covering samples as being either roll or sheet, and the materials from which each is made.

Service
Interior
Exterior

Emphasize that while the use of interior paints outdoors is merely uneconomical, the use of lead-base exterior paints indoors can be injurious to health.

Solvents
Mineral spirits
Turpentine
Lacquer thinner
Alcohol
Other

The student should be aware of the importance of using the correct solvent.

Instruction should include such possible side effects as destruction of particular plastics and spark ignition of vapors.

Emphasize skin and eye protection as well as hazards of inhalation and ingestion.

Application

Brush
 . Types
 . Sizes
 . Materials
Roller
 . Types
 Pan
 Pressure
 . Materials
 Mohair
 Lamb's wool
Spray
 . Suction
 . Pressure

Strive to develop students' judgment in selecting brush type and size, and bristle material. The student should know when it is more efficient to use a slightly "wrong" brush which is on hand, than to delay to obtain exactly the "correct" brush.

Emphasize the importance of using the type cover which is required for the type of paint to be applied.

Instruction should include a comparison of the relative advantages and disadvantages of the two spray systems.

The student should be able to demonstrate an ability to clean brushes, rollers, and spray equipment, to field standards of acceptability.

III — WALL COVERINGS

Roll materials
Paper
Fabric
Plastic

The student should be able to identify teacher-supplied samples as being either roll or sheet, and to state the materials from which each is made.

- Sheet materials
 - Melamine laminates
 - Vinyls
- Sizes and sealers
- Adhesives
 - Pastes
 - Glues
 - Contact cements
- Equipment
 - Measuring
 - Cutting
 - Preparing
 - Applying

Instruction should include *why* sizes and sealers are used, and *how* they work.

The strengths, and weaknesses, as well as the proper uses, of the various adhesives should be included in instruction.

The student should develop ability to select equipment as well as to use various pieces of equipment.

The teacher should be prepared to conduct remedial instruction in measurement and comparison.

Emphasize the supreme importance of straight, plumb or level joints, and well-matched panels.

UNIT IV — SAFETY

- Materials
 - Storage
 - Fire
 - . Type
 - . Extinguishers

The student should have a general understanding of combustion, and how it takes place. He should know that while most common materials require oxygen in atmosphere in order to burn, many supply their own oxygen and will, therefore, be difficult to extinguish with water.

The student will be able to list the common materials in each type of fire. He will be able to identify teacher-selected extinguishers as Type A, Type B, Type C, or Type B/C, and explain why each type must not be used on teacher-specified burning materials.

REDECORATING

- Sheet materials
 - Melamine laminates
 - Vinyls

- Sizes and sealers

Instruction should include *why* sizes and sealers must be used, and *how* they work.

- Adhesives

- Pastes
- Glues
- Contact cements

The strengths, and weaknesses, as well as the appropriate uses, of the various adhesives should be included in instruction.

- Equipment

- Measuring
- Cutting
- Preparing
- Applying

The student should develop ability to select and maintain, as well as to use various pieces of equipment.

The teacher should be prepared to conduct review or remedial instruction in measurement and computation.

Emphasize the supreme importance of straight, tight, plumb or level joints, and well-matched patterns.

T IV — SAFETY

- Materials

- Storage
- Fire
 - . Type
 - . Extinguishers

The student should have a general understanding of what combustion is, and how it takes place. He should know that while most common materials require oxygen from the atmosphere in order to burn, many supply their own oxygen and will, therefore, be difficult to extinguish with water.

The student will be able to list the common combustible materials in each type of fire. He will be able to identify teacher-selected extinguishers as Type A, Type B, Type C, or Type B/C, and explain why each must be, or must not be, used on teacher-specified burning materials.

- Equipment
 - Tools
 - . Electrical hazards
 - . Cuts
 - Ladders and scaffolds
- Personal
 - Eye and skin
 - Ingestion
 - Inhalation
- Procedures
 - First-Aid
 - Report forms
 - Workmen's Compensation
 - Hospitalization insurance

Standard safety procedures must not only be taught, but continuously enforced. The teacher must himself obey safety regulations and observe safety procedures.

The student should be able to identify common materials as being conductors or insulators.

Instruction should include the most basic of First-Aid procedures, completion of accident report forms, and general information on coverages, benefits, and applications for benefits of Compensation and hospital insurance plans.

CARPENTRY

Suggested Time: 180 Hours

UNIT I — TOOL UTILIZATION

TEACHING SUGGESTIONS

- o Type
 - Hand
 - Power
 - . Portable
 - . Stationary
- o Function
 - Cutting
 - Boring
 - Smoothing
 - Driving
 - Holding
 - Turning
 - Layout
- o Use
 - Woods
 - Metals
 - . Ferric
 - . Nonferric
 - Plastics
 - Other

Students should become familiar with the common tools through use rather than through memorization exercises. By this means he will also associate particular tools with specific work tasks.

Use of the common power tools should be required at entry-level proficiency with hand tools has been achieved.

The teacher must unvaryingly enforce all safety procedures regarding tools, and unfailingly observe himself. It is suggested that dated, written safety procedures be administered before students are allowed to use power tools, and that this as "passing" be kept on file.

Students should be able to maintain in proper condition of readiness, those tools customarily shared and adjusted by the craftsman, on the job.

UNIT II — MATERIALS UTILIZATION

- o Framing
 - DIM lumber
 - Laminated parts

The student must know the system of sizing lumber and be aware of the difference between nominal and actual dimensions. He should have a general knowledge of the chief species of wood used, and their properties.

The student should be instructed in why lumber is selected to provide superior performance.

CARPENTRY

Suggested Time: 180 Hours

— TOOL UTILIZATION

TEACHING SUGGESTIONS

Type
Hand
Power
 . Portable
 . Stationary

Students should become familiar with the common hand tools through use rather than through memorization exercises. By this means he will also associate particular tools with specific work tasks.

Function
Cutting
Boring
Smoothing
Driving
Holding
Turning
Layout

Use of the common power tools should be reserved until entry-level proficiency with hand tools has been attained.

The teacher must unvaryingly enforce all safety procedures regarding tools, and unfailingly observe them himself. It is suggested that dated, written tests of safe, proper procedures be administered before students are allowed to use power tools, and that those graded as "passing" be kept on file.

Use
Woods
Metals
 . Ferric
 . Nonferric
Plastics
Other

Students should be able to maintain in proper condition of readiness, those tools customarily sharpened, cleaned, and adjusted by the craftsman, on the jobsite.

II — MATERIALS UTILIZATION

Framing
DIM lumber
Laminated parts

The student must know the system of sizing DIM lumber and be aware of the difference between nominal and actual dimensions. He should have a general knowledge of the chief species of wood used, and their properties.

The student should be instructed in *why* laminated members provide superior performance.

- Insulation

- Rigid
- Flexible
- Granular

The student should be able to demonstrate understanding of the theory of heat transfer by examples of conduction, convection, and radiation.

The student should be able to identify by preferred use, samples of such common materials as fiberboards, expanded mica, aluminum foil, and asbestos fibers.

- Sheathing

- Composition
- Plywood
- Board

The student must know the systems of size sheathing; both panels and lineal stock. It should include comparison of the strengths and weaknesses of the common materials.

- Roofing

- Strip shingle
- Wood shingle
- Roll
- SIS
- Hot built-up
- Slate
- Tile

The student should be able to identify by examples, photos or valid sketches, or material samples of common roofing.

- Window and door units

- Rough openings
- Frame/jamb
- Doors
 - . Panel/flush
 - . Hollow core/solid
- Windows
 - . Double hung
 - . Casement
 - . Vent
 - . Gliding
- Glass

Instruct the student on the strengths, weaknesses, and method of operation of the various window and door units. The student should be aware of the cost of, and usefulness of, the mill book.

The student should be able to demonstrate, by teacher-selected means, an ability to identify and name and describe the characteristics of window and door units.

Instruction should include the "strengths" and weaknesses of glass.

- Exterior finish

- Shakes
- Wood siding
- Aluminum siding
- Composition

The student should be able to identify the existing interior and exterior surfaces, by sight, by "rapping," or by other nondestructive methods.

Insulation

- Rigid
- Flexible
- Granular

The student should be able to demonstrate an understanding of the theory of heat transfer by giving examples of conduction, convection, and radiation.

The student should be able to identify by name and preferred use, samples of such common materials as fiberboards, expanded mica, aluminum foil, and glass and asbestos fibers.

Sheathing

- Composition
- Plywood
- Board

The student must know the systems of sizes used for sheathing; both panels and lineal stock. Instruction should include comparison of the strengths and weaknesses of the common materials.

Roofing

- Strip shingle
- Wood shingle
- Roll
- SIS
- Hot built-up
- Slate
- Tile

The student should be able to identify by name "live" examples, photos or valid sketches, or materials samples of common roofing.

Window and door units

- Rough openings
- Frame/jamb
- Doors
 - . Panel/flush
 - . Hollow core/solid
- Windows
 - . Double hung
 - . Casement
 - . Vent
 - . Gliding
- Glass

Instruct the student on the strengths, weaknesses, and method of operation of the various window and door units. The student should be aware of the existence of, and usefulness of, the mill book.

The student should be able to demonstrate by any teacher-selected means, an ability to identify by name and describe the characteristics of the common window and door units.

Instruction should include the "strength" system for glass.

Exterior finish

- Shakes
- Wood siding
- Aluminum siding
- Composition

The student should be able to identify the nature of existing interior and exterior surfaces, either by sight, by "rapping," or by other nondestructive test.

- Interior finish
 - Gypsum board
 - Plypanel
 - Phenolic panels
 - Millwork
 - . Base
 - . Casing
 - . Mouldings
- Hardware
 - Locks and latches
 - . Surface
 - . Inset
 - Hinges
 - . Butt
 - . Double acting
 - . Cabinet
 - Door closers
 - . Hydraulic
 - . Pneumatic
 - Window mechanisms
 - . Sash balances
 - . Crank operators
 - Miscellaneous
 - . Door and drawer pulls
 - . Push and kick plates
 - . Door stops
 - . Panic bars
- Supplies
 - Nails
 - . Common
 - . Finishing
 - . Other
 - Screws
 - . Head shape and type
 - . Material

Instruction should include the strengths and weaknesses of the various materials, and the preferred use.

Students should be able to classify the common hardware, and describe its operation. They should be required to repair the cylinder of pin-tube or internal parts of hydraulic door closers.

It is necessary that students be able to identify the length, gauge, and type of nails. The system should be learned by using the information rather than by rote.

CARPENTRY

Interior finish

- Gypsum board
- Plypanel
- Phenolic panels
- Millwork
 - . Base
 - . Casing
 - . Mouldings

Instruction should include the strengths and weaknesses of the various materials, and the preferred points of use.

Hardware

- Locks and latches
 - . Surface
 - . Inset

Students should be able to classify the common building hardware, and describe its operation. They should *not* be required to repair the cylinder of pin-tumbler locks or internal parts of hydraulic door closers.

Hinges

- . Butt
- . Double acting
- . Cabinet

Door closers

- . Hydraulic
- . Pneumatic

Window mechanisms

- . Sash balances
- . Crank operators

Miscellaneous

- . Door and drawer pulls
- . Push and kick plates
- . Door stops
- . Panic bars

Supplies

- Nails
 - . Common
 - . Finishing
 - . Other

Screws

- . Head shape and type
- . Material

It is necessary that students be able to identify by sight the length, gauge, and type of nails and screws. The system should be learned by using the items, rather than by rote.

- Adhesives
 - . Epoxies
 - . Resorcinol resin
 - . Polyvinyl resin
 - . Contact cements
 - . Organic glues

The student should be made aware of the many and general purpose adhesives commonly used in construction and maintenance, and of the precautions attendant on the strengths and weaknesses of each. Emphasize that the label should be read and understood before the container is opened.

UNIT III — MAINTENANCE AND REPAIR

- o Exterior
 - Ramps and docks
 - Stairs and railings
 - Roofing and flashing
 - Gutters and downspouts
 - Vents and louvers
 - Awnings
 - Doors and windows
 - . Glass
 - . Screening
 - . Hardware
 - Surface finishes and trim
 - Stadium seating
- o Interior
 - Walls and ceilings
 - Floors
 - Stairways
 - Storage units
 - . Cabinets
 - . Shelves
 - . Racks
 - Doors and windows
 - Movable partitions
 - Seating
 - . Auditorium
 - . Gymnasium
 - Furniture

There are no valid guidelines regarding when a particular job becomes contract size instead of maintenance staff work — size and competence of staff, economic considerations, union contracts, and other local factors having effect. Each teacher must decide how "big" a job must be to remove it from "normal" maintenance staff work. This does not include instruction in depth of those students who are of benefitting therefrom, but minimum competencies required for employment should continue to be a criterion of student success.

- Adhesives
 - . Epoxies
 - . Resorcinol resin
 - . Polyvinyl resin
 - . Contact cements
 - . Organic glues

The student should be made aware of the many special and general purpose adhesives commonly used in building construction and maintenance, and of the preferred uses attendant on the strengths and weaknesses of each. Emphasize that the label should be read and understood before the container is opened.

III — MAINTENANCE AND REPAIR

Exterior

- Ramps and docks
- Stairs and railings
- Roofing and flashing
- Gutters and downspouts
- Vents and louvers
- Awnings
- Doors and windows
 - . Glass
 - . Screening
 - . Hardware
- Surface finishes and trim
- Stadium seating

There are no valid guidelines regarding where a particular job becomes contract size instead of maintenance staff work — size and competency of staff, economic considerations, union contracts, and other local factors having affect. Each teacher must decide how "big" a job must be to remove it from "normal" maintenance staff work. This does not preclude instruction in depth of those students capable of benefitting therefrom, but minimum competencies required for employment should continue to be the criteria of student success.

Interior

- Walls and ceilings
- Floors
- Stairways
- Storage units
 - . Cabinets
 - . Shelves
 - . Racks
- Doors and windows
- Movable partitions
- Seating
 - . Auditorium
 - . Gymnasium
- Furniture

UNIT IV — ADDITIONS AND NEW WORK

- Framing
 - To existing structure
 - Freestanding

Emphasize the importance of blending additions with existing structures, appearance wise.

- Blending-in
 - Roofing
 - Walls
 - Floors
 - Trim

Joints of new-to-old should be "staggered" leaving an obvious outline.

- Form building
 - Walks
 - Steps
 - Slabs

Emphasize the importance of accurate work in building, even though the structures are to be demolished.

CARPENTRY

V — ADDITIONS AND NEW WORK

Framing
To existing structure
Freestanding

Emphasize the importance of blending additions to existing structures, appearance wise.

Blending-in
Roofing
Walls
Floors
Trim

Joints of new-to-old should be "staggered" to avoid leaving an obvious outline.

Form building
Walks
Steps
Slabs

Emphasize the importance of accurate work in form building, even though the structures are temporary.

MASONRY

Suggested Time: 60 Hours

UNIT I — CONCRETE

TEACHING SUGGESTIONS

o Composition

- Cement
- Aggregate
- Water
- Admixtures

The student should know that different types of cements and aggregates are available, as well as their proper proportions, to obtain concrete whose quality meets the requirements for specific uses. He should understand that specifications should be carefully followed and it is not necessary that he memorize types, proportions, or designations of components.

Emphasize proper methods of storing and handling cement.

o Preparation

- Proportions
- Equipment
 - . Hand mix
 - . Power mix
- Procedure

The student should be able to combine ingredients to make concrete both by hand and by machine, the specific proportions for a stated amount of concrete, the mix being consistent for any teacher-selected use.

Emphasize the importance of maintaining the consistency of the mix.

o Placing

- Pouring
- Finishing
 - . Screed
 - . Float
 - . Edger
 - . Groover
 - . Trowel
- Protecting
- Curing

The student should sufficiently understand the effects of the methods by which concrete sets to be aware of the effects of pouring on a new pour of too much or too little water, or flowing water, and of the need for moist curing. He should be familiar with all the defects of concrete, such as honeycomb.

The student should be able to place, screed, float, edge, groove, and trowel a section of concrete, the results being to field standards of quality.

o Use

- Walks
- Curbs
- Slabs
- Footings

MASONRY

Suggested Time: 60 Hours

I — CONCRETE

TEACHING SUGGESTIONS

Composition

- Cement
- Aggregate
- Water
- Admixtures

The student should know that different types of cement and aggregates are available, as well as various proportions, to obtain concrete whose qualities fit it for specific uses. He should understand that mix specifications should be carefully followed. It is not necessary that he memorize types, properties, and designations of components.

Emphasize proper methods of storing and handling cement.

Preparation

- Proportions
- Equipment
 - . Hand mix
 - . Power mix
- Procedure

The student should be able to combine in proper sequence, both by hand and by machine, the specified components of a stated amount of concrete, the mix being of proper consistency for any teacher-selected use.

Emphasize the importance of maintaining the purity of the mix.

Placing

- Pouring
- Finishing
 - . Screed
 - . Float
 - . Edger
 - . Groover
 - . Trowel
- Protecting
- Curing

The student should sufficiently understand the process by which concrete sets to be aware of the adverse effects on a new pour of too much or too little heat, and of rain or flowing water, and of the need for moisture during curing. He should be familiar with all means of avoiding honeycomb.

The student should be able to place, screed, float, and trowel a section of concrete, the resulting finish being to field standards of quality.

Use

- Walks
- Curbs
- Slabs
- Footings

- Walls
- Stairs
- Floors
- o Patching
 - Trimming
 - Slurry
 - Filling

Preparing and filling holes and cracks is a must for masonry maintenance men. They should be adept at all phases of this work.

UNIT II — PLASTER

- o Composition
 - Water
 - Sand
 - Fiber
 - Aggregates
 - . Expanded mica
 - . Other
 - Cements
 - . Limes
 - . Gypsum
 - Plaster of paris
 - Keene's cement
 - . Portland
 - Prepared mixes
- o Base surfaces
 - Type
 - . Metal lath
 - . Wood lath
 - . Gypsum board
 - . Existing plaster
 - Holes
 - Cracks
 - Loose sections
 - Preparation
 - . Cleaning
 - . Dovetailing
 - . Wetting

It is not necessary that the students memorize the exact components of the various plasters. It is necessary that they know the basic components of each plaster, that special components for particular uses exist, and where to find the specifications for the type needed.

Emphasize the importance of following the manufacturer's instructions for using plaster.

The student should be able to identify the various plaster bases and describe the special purposes and specific uses of each. He should be able to demonstrate an ability to prepare base surfaces for plaster.

MASONRY

- Walls
- Stairs
- Floors

- Patching
- Trimming
- Slurry
- Filling

Preparing and filling holes and cracks is a skill which is a must for masonry maintenance men. The student should be adept at all phases of this work except color matching.

II — PLASTER

- Composition
 - Water
 - Sand
 - Fiber
 - Aggregates
 - . Expanded mica
 - . Other
 - Cements
 - . Limes
 - . Gypsum
 - Plaster of paris
 - Keene's cement
 - . Portland
 - Prepared mixes

- Base surfaces
 - Type
 - . Metal lath
 - . Wood lath
 - . Gypsum board
 - . Existing plaster
 - Holes
 - Cracks
 - Loose sections
 - Preparation
 - . Cleaning
 - . Dovetailing
 - . Wetting

It is not necessary that the students memorize the exact components of the various plasters. It is necessary that they know the basic components of any plaster, that special components for particular uses exist, and where to find the specifications for the type needed.

Emphasize the importance of following exactly, the manufacturer's instructions for using prepared mixes.

The student should be able to identify samples of common plaster bases and describe the special properties and specific uses of each. He should be able to demonstrate an ability to prepare base surfaces for application of plaster.

- Mixing
 - Proportions
 - Procedures
 - . Tools
 - . Equipment

The student should be able to mix, to field quality, any plaster for which specifications are provided, and for which equipment and materials are available.

Emphasize the importance of keeping components, tools and equipment, clean and free of impurities.

- Application
 - Base coat
 - Finish coat
 - Tools

While new plastering of comparatively large areas should not be neglected, emphasis should be placed on the ability in patching should be at a higher level than is entry-level ability in replastering.

UNIT III — CERAMIC TILE

- Problems
 - Broken fixtures
 - Cracked tile
 - Lost grout
- Repair
 - Removing damaged units
 - . Tools
 - . Procedures
 - Resetting
 - . Cutting
 - Tools
 - Procedures
 - . Adhesives
 - Concrete plaster
 - Mastics
 - Regrouting
 - . Mixing
 - . Applying

The setting of ceramic tile is a highly specialized field. Maintenance staff involvement is, usually limited to regrouting and to replacing fixtures and the occasional cracked tile.

Students should be made aware of the much greater difficulty inherent in repairing tile set in plaster, than in that set in mastic.

The student should be able to demonstrate ability to remove damaged tile and fixtures, prepare the base surface, and set the replacement.

The student should be able to demonstrate ability to prepare and regrout an existing tile surface to results equaling or exceeding field standards of acceptable quality.

- Mixing
- Proportions
- Procedures
 - . Tools
 - . Equipment

The student should be able to mix, to field standards of quality, any plaster for which specifications have been provided, and for which equipment and necessary components are available.

Emphasize the importance of keeping components, and tools and equipment, clean and free of impurities.

- Application
- Base coat
- Finish coat
- Tools

While new plastering of comparatively large surfaces should not be neglected, emphasis should be on repairing relatively small areas of existing plaster. Entry-level ability in patching should be at a higher level of quality, than is entry-level ability in replastering.

III — CERAMIC TILE

- Problems
- Broken fixtures
- Cracked tile
- Lost grout

The setting of ceramic tile is a highly specialized field. Maintenance staff involvement is, therefore, usually limited to regrouting and to replacing broken fixtures and the occasional cracked tile.

- Repair
- Removing damaged units
 - . Tools
 - . Procedures
- Resetting
 - . Cutting
 - Tools
 - Procedures
 - . Adhesives
 - Concrete plaster
 - Mastics
- Regrouting
 - . Mixing
 - . Applying

Students should be made aware of the much greater difficulty inherent in repairing tile set in concrete plaster, than in that set in mastic.

The student should be able to demonstrate an entry-level ability to remove damaged tile and fixtures, prepare the base surface, and set the replacement units.

The student should be able to demonstrate an ability to prepare and regrout an existing tile surface, the results equaling or exceeding field standards for acceptable quality.

UNIT IV — BRICK AND BLOCK

- Pointing
 - Preparing the joint
 - . Raking
 - . Wetting
 - Mortar
 - . Mixing
 - . Applying
 - Tooling

- Alterations
 - Cutting openings
 - . Equipment
 - Hand
 - Power
 - . Procedure
 - Shoring
 - Safety

- Setting new units
 - Description
 - . Size
 - . Type
 - . Absorptivity
 - Layout
 - . Running bond
 - . Random bond
 - . Common bond
 - . English bond
 - . Other
 - Procedure
 - . Methods
 - . Tools

Instruction in mixing of mortar should include the development of an understanding of the properties of cements and the effects of each on the mortar.

Students should be able to mix mortars to specifications, and to a proper working condition. They should develop the ability to distinguish mortar that has stiffened through evaporation can be retempered — and mortar which has

The student should be able to demonstrate the ability to prepare joints, mix mortar, and tool the joints.

The students should gain experience in use of tools and equipment — hand and power; chipping, boring. Hardhats, eyeshields, respirators, shoes must be mandatory equipment.

Instruction must emphasize proper shoring when it is needed.

Instruction and daily use should acquaint students with the more common styles, sizes, and shapes of brick and block, and with the relative absorption of each.

The student should be able to identify by name the common bonds represented by teacher-supplied photographs, or live samples. He should be able to point out those bonds widely used in his geographic area.

The student should be able to lay up a section of block; joints uniform in size, all plumb, and true.

V — BRICK AND BLOCK

- Pointing
- Preparing the joint
 - . Raking
 - . Wetting
- Mortar
 - . Mixing
 - . Applying
- Tooling

Instruction in mixing of mortar should include development of an understanding of the properties of various cements and the effects of each on the mortar.

Students should be able to mix mortars to provided specifications, and to a proper working consistency. They should develop the ability to distinguish between mortar that has stiffened through evaporation — and can be retempered — and mortar which has set.

The student should be able to demonstrate an entry-level ability to prepare joints, mix mortar, and point and tool the joints.

- Alterations
 - Cutting openings
 - . Equipment
 - Hand
 - Power
 - . Procedure
 - Shoring
 - Safety

The students should gain experience in use of all tools and equipment — hand and power; chipping, cutting, and boring. Hardhats, eyeshields, respirators, and safety shoes must be mandatory equipment.

Instruction must emphasize proper shoring, and why it is needed.

- Setting new units
 - Description
 - . Size
 - . Type
 - . Absorptivity
 - Layout
 - . Running bond
 - . Random bond
 - . Common bond
 - . English bond
 - . Other
 - Procedure
 - . Methods
 - . Tools

Instruction and daily use should acquaint the students with the more common styles, sizes, and shapes of brick and block, and with the relative absorptivity of each.

The student should be able to identify by name, any of the common bonds represented by teacher-selected sketches, photographs, or live samples. He should be able to lay out those bonds widely used in his geographical area.

The student should be able to lay up a section of brick, and of block; joints uniform in size, all work level, plumb, and true.

- Flashings
- Vents

Instruction on flashings should include purpose, materials, the installation of thruwall flashing, and fabrication and installation of counter flashing.

- o Washing
 - Materials
 - . Acid
 - . Soap solution
 - . Dry cleaners
 - Equipment
 - Safety

Students should know why new masonry must be cleaned. They should be acquainted with the various types of cleaners, their properties, and proper methods of use. The teacher must emphasize safety and conformity to procedure. Demonstrating the effects of muriatic acid on samples of cloth, wood, and metal is frequently useful.

- o Waterproofing
 - Materials
 - . Chemical sealers
 - . Bituminous sealers
 - Equipment
 - Procedure

Instruction should include why waterproofing is needed, what materials are used in what locations, and how the work is performed. Students should attain entry-level proficiency in applying parge coatings and at least the one type sealer most used in that geographical area.

ELECTRICITY

Suggested Time: 60 Hours

UNIT I — ELECTRICAL ENERGY

TEACHING SUGGESTIONS

- o Nature of Electricity
 - Electron theory
 - Production of AC
 - Transmission of current
 - . Conductors
 - . Insulators
- o Safety
 - Shock
 - Fire
 - . Type B/C extinguishers
 - Equipment
 - First-aid

Instruction should include an overview electrical theory, production of current, transmission of current.

The student should be able to classify conductor or insulator, any commonly used materials.

Safety instruction is of supreme importance in the occupational area. The student should be alert to the danger of shock and fire of electrical energy. Use of safety equipment must be unvaryingly enforced. All students must learn basic first-aid procedures; they *must* know what to do in rescue procedure, what extinguishers *must not* be used on electrical fires,

UNIT II — CIRCUITS

- o Codes
 - National
 - Local
- o Conductors
 - Type
 - . Armored
 - . Nonmetallic
 - Sizes
 - Conduits

The Code is constantly changing; students must be taught to check its requirements rather than rely on memory. The teacher must be the final authority in each case, before power is switched on.

The shop inventory should include a representative sample of all the various sizes and types of materials encountered by electrical maintenance. Students should learn component identification of these materials.

ELECTRICITY

Suggested Time: 60 Hours

UNIT I — ELECTRICAL ENERGY

TEACHING SUGGESTIONS

- o Nature of Electricity
 - Electron theory
 - Production of AC
 - Transmission of current
 - . Conductors
 - . Insulators

Instruction should include an overview of basic electrical theory, production of current, and transmission of current.

The student should be able to classify as either conductor or insulator, any commonly available material.

- o Safety
 - Shock
 - Fire
 - . Type B/C extinguishers
 - Equipment
 - First-aid

Safety instruction is of supreme importance in this occupational area. The student should be continually alert to the danger of shock and fire inherent in use of electrical energy. Use of safety equipment must be unvaryingly enforced. All students should know basic first-aid procedures; they *must* know what *not* to do in rescue procedure, what extinguishing agent *must not* be used on electrical fires, and *why not*.

UNIT II — CIRCUITS

- o Codes
 - National
 - Local
- o Conductors
 - Type
 - . Armored
 - . Nonmetallic
 - Sizes
 - Conduits

The Code is constantly changing; students should be taught to check its requirements rather than rely on memory. The teacher must be the final "inspector" in each case, before power is switched on.

The shop inventory should include a realistic supply of all the various sizes and types of materials commonly encountered by electrical maintenance men. Students should learn component identification through use of these materials.

- o Connection boxes
 - Types
 - Sizes
 - Methods of installing

- o Switches
 - Type
 - . Mechanical
 - . Mercury
 - . Rheostat
 - Function
 - . Single-pole
 - . Three-way
 - . Other

Students should have a general understanding of several types of switches function, that able to diagnose problems resulting from

- o Receptacles
 - Interior
 - Exterior
 - Higher voltage

Emphasize the importance of clean, tight proper grounding.

- o Connections
 - Live
 - . Screw clamp
 - . Spring clamp
 - Ground

The student should be able to install and representative circuits, diagnose and re components, and reset tripped breakers, forming to the Underwriters Code and standard procedure.

- o Protective devices
 - Fuses
 - . Plug
 - . Cartridge
 - Unit
 - Replacable element
 - Breakers

Emphasize the importance of circuit protection and of maintaining the correct rating for circuit.

Connection boxes
Types
Sizes
Methods of installing

Switches
Type
 Mechanical
 Mercury
 Rheostat
Function
 Single-pole
 Three-way
 Other

Students should have a general understanding of how the several types of switches function, that they may be able to diagnose problems resulting from faulty switches.

Receptacles
 Interior
 Exterior
Higher voltage

Emphasize the importance of clean, tight connections and proper grounding.

Connections
 Live
 Screw clamp
 Spring clamp
 Ground

The student should be able to install and connect representative circuits, diagnose and replace defective components, and reset tripped breakers, all work conforming to the Underwriters Code and standards of safe procedure.

Protective devices
 Fuses
 Plug
 Cartridge
 Unit
 Replacable element
Breakers

Emphasize the importance of circuit protective devices, and of maintaining the correct rating for the particular circuit.

UNIT III — ELECTRICAL DEVICES

- Illumination
 - Type
 - . Incandescent
 - . Fluorescent
 - Cleaning
 - Maintenance
 - . Lighting elements
 - . Diffusers
 - . Reflectors
 - . Ballasts
 - . Emergency lighting units
 - Unit replacement
- Motors
 - Cleaning
 - Lubricating
 - Replacing brushes
 - Checking connections
- Alarm and signal systems
 - Device
 - . Bell
 - . Buzzer
 - . Flasher
 - Checking connections
 - Checking switches
 - Routine maintenance

School facilities should provide permanent and shop inventory should provide practice will afford students experience in cleaning, repairing, and replacing both incandescent and fluorescent lighting units.

School facilities should provide numerous electric motors, in addition to shop samples, which will provide practice in motor maintenance.

Emphasize the importance of proper maintenance in achieving the total reliability necessary for alarm and signal systems.

It is not necessary that students be capable of installing a system; they should be able to check and replace defective components.

The use of the scheduled-inspection maintenance system should be taught.

I — ELECTRICAL DEVICES

Illumination

Type

Incandescent

Fluorescent

Cleaning

Maintenance

Lighting elements

Diffusers

Reflectors

Ballasts

Emergency lighting units

Unit replacement

School facilities should provide permanent installations, and shop inventory should provide practice units, which will afford students experience in cleaning, maintaining, repairing, and replacing both incandescent and fluorescent lighting units.

Motors

Cleaning

Lubricating

Replacing brushes

Checking connections

School facilities should provide numerous electric motors, in addition to shop samples, which will provide practice in motor maintenance.

Alarm and signal systems

Device

Bell

Buzzer

Flasher

Checking connections

Checking switches

Routine maintenance

Emphasize the importance of proper maintenance in achieving the total reliability necessary to alarm and signal systems.

It is not necessary that students be capable of installing a system; they should be able to locate and replace defective components.

The use of the scheduled-inspection maintenance chart should be taught.

PLUMBING

Suggested Time: 45 Hours

TEACHING SUGGESTIONS

UNIT I — WATER SUPPLY

- Piping
 - Material
 - . Iron
 - . Copper
 - . Plastics
 - Sizes
- Fittings
 - Material
 - Sizes
 - Types
 - . Elbows
 - . Tees
 - . Couplings
 - . Unions
 - . Other
- Valves
 - Automatic
 - . Check
 - . Relief
 - . Float
 - . Other
 - Nonautomatic
 - . Globe
 - . Gate
 - . Waste
 - . Other
 - Maintenance
 - . Washers
 - . Packing

Instruction and practice should sufficiently acquaint the student with the common pipe materials, properties of each, that he can identify materials at sight and describe the strengths and weaknesses.

The students should have a general knowledge of standard pipe diameters and lengths, and understand the O.D. measurement.

The student should be able to select from a list of any type, size, and material specified.

Students should be able to identify by name any common type valve. Instruction should include familiarization with internal features of valves and areas of probable trouble. Emphasize proper installation.

Students should be able to replace washers and perform routine maintenance of common valves.

PLUMBING

Suggested Time: 45 Hours

— WATER SUPPLY

TEACHING SUGGESTIONS

Piping
Material
Iron
Copper
Plastics
Sizes

Instruction and practice should sufficiently familiarize the student with the common pipe materials, and with the properties of each, that he can identify materials on sight and describe the strengths and weaknesses of each.

The students should have a general knowledge of standard pipe diameters and lengths, and understand I.D. and O.D. measurement.

Fittings
Material
Sizes
Types
Elbows
Tees
Couplings
Unions
Other

The student should be able to select from stock, fittings of any type, size, and material specified by the teacher.

Valves
Automatic
Check
Relief
Float
Other
Nonautomatic
Globe
Gate
Waste
Other
Maintenance
Washers
Packing

Students should be able to identify by name and function, any common type valve. Instruction should include familiarization with internal features of each type, and areas of probable trouble. Emphasize proper flow installation.

Students should be able to replace washers and packing, and perform routine maintenance of common water system valves.

- o Faucets
 - Plain
 - Mixing
 - Single-lever

Instruction should include Fuller and ground but should concentrate on compression faucet.

The student should be able to remove and retype faucets. He should be able to diagnose, disassemble, repair, and reassemble all stop compression faucet.

- o Location
 - Buildings
 - . Sinks and lavatories
 - . Baths and showers
 - . Sanitary facilities
 - . Drinking fountains
 - . Laundry units
 - . Water heaters
 - Exterior
 - . Lawn sprinklers
 - . Drinking fountains
 - . Sill cocks

Instruction and practice should acquaint the various types of terminals of water supply and the maintenance and probable trouble. Emphasize the importance of quickly locating shut-offs.

- o Weather protection
 - Insulation
 - Draining

Students should be aware of the danger of exposed lines. They should know the method of thawing, and be able to properly drain lines. They should have an understanding of safe thawing procedure.

- o Hot water supply
 - Relief valve

The student should be able to explain the operation of the pressure-temperature relief valve, where needed.

- o Codes

UNIT II — DRAINAGE SYSTEM

- o Functions
 - Main soil lines
 - Waste lines
 - Storm drains

Students should recognize the physical and differences of the various drain systems, and identify examples of each.

PLUMBING

- Faucets
 - Plain
 - Mixing
 - Single-lever

Instruction should include Fuller and ground-key faucets, but should concentrate on compression faucets.

The student should be able to remove and replace all type faucets. He should be able to diagnose troubles, disassemble, repair, and reassemble all styles of compression faucet.

- Location
 - Buildings
 - . Sinks and lavatories
 - . Baths and showers
 - . Sanitary facilities
 - . Drinking fountains
 - . Laundry units
 - . Water heaters
 - Exterior
 - . Lawn sprinklers
 - . Drinking fountains
 - . Sill cocks

Instruction and practice should acquaint student with the various types of terminals of water supply lines, and the maintenance and probable trouble areas of each. Emphasize the importance of quickly locating line shut-offs.

- Weather protection
 - Insulation
 - Draining

Students should be aware of the danger of freezing of exposed lines. They should know the methods of insulating, and be able to properly drain lines. They should have an understanding of safe thawing procedures.

- Hot water supply
 - Relief valve

The student should be able to explain the functioning of the pressure-temperature relief valve, and why it is needed.

- Codes

UNIT II — DRAINAGE SYSTEM

- Functions
 - Main soil lines
 - Waste lines
 - Storm drains

Students should recognize the physical and functional differences of the various drain systems, and be able to identify examples of each.

- Waste disposal system
 - Municipal
 - Septic
 - Codes

Instruction should include an overview of and mechanics of both municipal and septic

Students should be able to use — but not to memorize — plumbing codes.

- Materials
 - Iron
 - Copper
 - Glass
 - Plastic
 - Cast iron
 - Other

The student should be able to identify any selected sample drain as to material, size uses.

- Fittings
 - Couplings
 - Elbows
 - Tees
 - Increasers
 - Clean-outs
 - Other

- Traps
 - S
 - P
 - Drum
 - Other

The student should be able to identify and functioning of the various traps. He must understand the health and safety reasons existence, and the principle on which the

- Stacks
 - Vent
 - Ventilation

Emphasize the importance of ventilating and Instruction should include the difference and ventilation stacks.

- Freeing stoppages
 - Waste lines
 - . Chemicals
 - . Force cup
 - . Snake

Instruction should include probable problems the nature of materials usually causing stoppages at each such point. Students should be instructed in selection and safe use of chemical and methods of clearing stoppages, and made aware of improper or careless use.

Waste disposal system
Municipal
Septic
Codes

Instruction should include an overview of the principles and mechanics of both municipal and septic systems.

Students should be able to use — but not be expected to memorize — plumbing codes.

Materials
Iron
Copper
Glass
Plastic
Cast iron
Other

The student should be able to identify any teacher-selected sample drain as to material, size, and proper uses.

Fittings
Couplings
Elbows
Tees
Increasers
Clean-outs
Other

Traps
S
P
Drum
Other

The student should be able to identify and describe the functioning of the various traps. He must completely understand the health and safety reasons for their existence, and the principle on which they function.

Stacks
Vent
Ventilation

Emphasize the importance of ventilating drains. Instruction should include the difference between vent and ventilation stacks.

Freeing stoppages
Waste lines
Chemicals
Force cup
Snake

Instruction should include probable problem points and the nature of materials usually causing stoppages at each such point. Students should be instructed in selection and safe use of chemical and mechanical means of clearing stoppages, and made aware of the hazards of improper or careless use.

- Main soil lines
 - . Snake
 - . Auger
 - . Fixture removal
- Traps
 - . Clean-out plug
 - . Trap removal

Emphasize the danger inherent in large volume backed up — especially vertically — by stressing the importance of using correct methods of clearing under these conditions.

UNIT III — JOINING COMPONENTS

- o Galvanized iron
 - Cutting
 - . Manual
 - . Machine
 - Threading
 - . Equipment
 - . Procedure
 - Joining
 - . Equipment
 - . Procedure
 - Testing
- o Copper
 - Cutting
 - Sweating
 - . Preparation
 - . Joining
 - Testing

The student should be able to demonstrate an ability to:

Cut galvanized pipes within acceptable lengths, using each cutting method commonly used in the field.

Cut standard threads, using both manual and power methods.

Join sections of threaded pipe and special fittings into a watertight unit.

Cut copper tubing to length, using wheel and hacksaw.

Prepare components for joining, using correct abrasives and flux.

Join sections of tubing and selected fittings into a watertight unit, using solder and propane butane torch.

PLUMBING

- Main soil lines
 - . Snake
 - . Auger
 - . Fixture removal
- Traps
 - . Clean-out plug
 - . Trap removal

Emphasize the danger inherent in large volumes of liquid backed up — especially vertically — by stoppages, and the importance of using correct methods of opening drains under these conditions.

III — JOINING COMPONENTS

- Galvanized iron
 - Cutting
 - . Manual
 - . Machine
 - Threading
 - . Equipment
 - . Procedure
 - Joining
 - . Equipment
 - . Procedure
 - Testing

The student should be able to demonstrate an entry-level ability to:

Cut galvanized pipes within acceptable tolerances of stated lengths, using each cutting tool commonly used in the field.

Cut standard threads, using both manual and power dies.

Join sections of threaded pipe and specified fittings into a watertight unit.

- Copper
 - Cutting
 - Sweating
 - . Preparation
 - . Joining
 - Testing

Cut copper tubing to length, using wheelcutter and hacksaw.

Prepare components for joining, using coated abrasives and flux.

Join sections of tubing and selected fittings into a watertight unit, using solder and propane or butane torch.

The student should be able to demonstrate an entry-level ability to:

- Plastics
 - Clamping
 - Solvent welding
 - Testing

Cut, fit, and clamp or solvent-weld components of plastic pipe to form a watertight unit.

- Cast iron
 - Cutting
 - . Hacksaw
 - . Cold chisel
 - . Pipe cutter
 - Leading
 - . Packing
 - . Pouring
 - . Calking
 - Testing

Cut bell-and-spigot pipes within acceptable tolerances, using cold chisel and chain wheel cutter.

Assemble, pack, lead, and calk specified components into a unit which will remain watertight under specified gravitational or introduced pressures.

- Supports
 - Straps
 - Hangers
 - Other

Provide supports as required by the type, material, diameter, and run length of pipe.

Emphasize use of eye, foot, and other safety equipment.

Instruction should include safeguarding against such hazards as spattering of hot flux and explosion of molten lead poured into wet bell-and-spigot joints.

CLIMATE CONTROL

Suggested Time: 45 Hours

UNIT I — INTRODUCTORY INFORMATION

TEACHING SUGGESTIONS

- o Factors
 - Temperature
 - . Conduction
 - . Convection
 - . Radiation
 - Humidity
 - . Too high
 - . Too low
- o Application
 - Food storage
 - Laboratories
 - Electronics manufacturing
 - Personal comfort
- o Climate control systems
 - Heating systems
 - . Warm air
 - . Hydronic
 - . Radiant
 - Cooling systems
 - . Forced air flow
 - . Refrigeration
 - Humidifiers
 - . Plate
 - . Drum
 - . Dehumidifiers

Students should be instructed in what heat is, how it travels, in which it travels, and why some materials are insulators and others are insulators. The teacher should explain the molecular motion theory of heat.

Emphasize the relationship of relative humidity to temperature in achieving comfort, and the effects of improper humidity.

The students should be made aware of the applications of climate control which are more exacting than the obvious use in human comfort.

Instruction should include a comparative study of the mechanical, financial, esthetic, and safety aspects of each of the three main heating methods.

The student should be aware of the nature of evaporative cooling through forced air flow, the advantages and disadvantages of cooling with refrigerated air.

The student should understand the principles of operation of humidifiers and dehumidifiers, the types of each type, and the effects of "limb" elements.

CLIMATE CONTROL

Suggested Time: 45 Hours

I — INTRODUCTORY INFORMATION

TEACHING SUGGESTIONS

Factors

- Temperature
 - . Conduction
 - . Convection
 - . Radiation
- Humidity
 - . Too high
 - . Too low

Students should be instructed in what heat is, the ways in which it travels, and why some materials are conductors and others are insulators. The teacher should be prepared to explain the molecular motion theory of heat transfer.

Emphasize the relationship of relative humidity to temperature in achieving comfort, and the effects and side effects of improper humidity.

Application

- Food storage
- Laboratories
- Electronics manufacturing
- Personal comfort

The students should be made aware of the many important applications of climate control which are more technically exacting than the obvious use in human comfort.

Climate control systems

- Heating systems
 - . Warm air
 - . Hydronic
 - . Radiant
- Cooling systems
 - . Forced air flow
 - . Refrigeration
- Humidifiers
 - . Plate
 - . Drum
- Dehumidifiers

Instruction should include a comparative examination of the mechanical, financial, esthetic, and functional aspects of each of the three main heating systems.

The student should be aware of the nature and limitations of evaporative cooling through forced air flow, and of the advantages and disadvantages of cooling through refrigerated air.

The student should understand the principle and functioning of humidifiers and dehumidifiers, the effectiveness of each type, and the effects of "liming" on the evaporator elements.

UNIT II — WARM AIR SYSTEMS

- Furnaces
 - Central
 - Room unit
- Fuels
 - Oil
 - Gas
- Heat flow
 - Plenum
 - Blower
 - . Motor
 - . Controls
 - Distribution ducts
 - Registers
 - Return ducts
 - Filters
 - . Mechanical
 - . Electronic
- Maintenance
 - Cleaning
 - . Furnace
 - Combustion parts
 - Grills
 - . Filters
 - . Humidifiers
 - . Registers
 - . Thermostats
 - Lubricating
 - Restarting
 - Regulating
 - . Thermostats
 - . Fuel/air flow
 - . Humidistats

Instruction should include room unit furnace emphasis must be on central systems.

The students should know the comparative major problems of the common fuels, as well as requirements for different combustion equipment each requires.

Emphasize safety procedures regarding leaks.

The student should be able to describe, orally or in writing, the circulation of air through a forced warm air system, list the components, and explain the functioning of each.

The student should be able to describe, orally or in writing, how a forced warm air system is installed and the effects of duct size on distribution.

The student should be able to perform all maintenance procedures, in conformance with manufacturer's procedural charts.

The student should be able to repair or replace damaged sections of duct, and to assemble a new branch.

The student should be able to locate and repair faulty components, and to install replacement parts.

— WARM AIR SYSTEMS

Furnaces
Central
Room unit

Instruction should include room unit furnaces, although emphasis must be on central systems.

Fuels
Oil
Gas

The students should know the comparative maintenance problems of the common fuels, as well as recognizing the different combustion equipment each requires.

Emphasize safety procedures regarding leaks and fires.

Air flow
Plenum
Blower
Motor
Controls
Distribution ducts
Registers
Return ducts
Filters
Mechanical
Electronic

The student should be able to describe, orally or in writing, the circulation of air through a forced warm air system, list the components, and explain the functioning of each.

The student should be able to describe, orally or in writing, how a forced warm air system is "balanced," and the effects of duct size on distribution.

Maintenance
Cleaning
Furnace
Combustion parts
Grills
Filters
Humidifiers
Registers
Thermostats
Lubricating
Restarting
Regulating
Thermostats
Fuel/air flow
Humidistats

The student should be able to perform all routine maintenance procedures, in conformance with provided procedural charts.

The student should be able to repair or remove and replace damaged sections of duct, and to assemble and cut in a new branch.

The student should be able to locate and remove faulty components, and to install replacement parts.

UNIT III — HYDRONIC SYSTEMS

- o Boilers
 - Hot water
 - Steam
- o Fuels
 - Gas
 - Oil
- o Heat flow
 - Gravity flow
 - . One pipe
 - . Two pipe
 - Forced flow
 - Radiators
 - . Convactor cabinets
 - . Baseboard cabinets
 - . Radiant panels
 - . Cast iron
- o Maintenance
 - Cleaning
 - . Furnace
 - Combustion parts
 - Boiler
 - . Radiators
 - . Lines
 - . System controls
 - Thermostats
 - Aquastats
 - Relief valves
 - Lubrication
 - . Circulators
 - Restarting
 - Regulating
 - . Thermostats
 - . Aquastats
 - . Valves
 - . Fuel delivery

The student should have a basic knowledge of hot water systems. He should not be expected to be familiar with the details of the various types.

The student should be able to demonstrate the functioning of the various distribution systems, and an ability to identify sample systems.

Instruction should include a comparative evaluation of the relative advantages of the various radiator types and when connected to the different distribution systems.

Emphasize the importance of keeping radiator dust mats.

The student should be able to perform all maintenance procedures in conformance with procedural charts and factory specifications.

The student should be able to locate faults and repair or remove and replace parts where the procedure is commonly within the province of the maintenance departments in the field.

Emphasize the importance of maintaining correct pressure, and of maintaining accurate functioning of pressure indicators and safety valves.

II — HYDRONIC SYSTEMS

Boilers

Hot water

Steam

The student should have a basic knowledge of steam and hot water systems. He should not be expected to become familiar with the details of the various types and models.

Fuels

Gas

Oil

Heat flow

Gravity flow

. One pipe

. Two pipe

Forced flow

Radiators

. Convector cabinets

. Baseboard cabinets

. Radiant panels

. Cast iron

The student should be able to demonstrate an understanding of the functioning of the various distribution systems, and an ability to identify samples by type.

Instruction should include a comparative examination of the relative advantages of the various radiators per se, and when connected to the different distribution systems.

Emphasize the importance of keeping radiators free of dust mats.

Maintenance

Cleaning

. Furnace

Combustion parts

Boiler

. Radiators

. Lines

. System controls

Thermostats

Aquastats

Relief valves

Lubrication

. Circulators

Restarting

Regulating

. Thermostats

. Aquastats

. Valves

. Fuel delivery

The student should be able to perform all routine maintenance procedures in conformance with provided procedural charts and factory specifications.

The student should be able to locate faulty components and repair or remove and replace parts where the procedure is commonly within the province of maintenance departments in the field.

Emphasize the importance of maintaining correct internal pressure, and of maintaining accurate functioning of pressure indicators and safety valves.

UNIT IV — COOLING SYSTEMS

- o Room unit
 - Types and sizes
 - . Cooling needs
 - . Structure design factors
 - . Installation
 - Adjustments
 - . Deflectors
 - . Fan speed control
 - . Vent/Cool controls
 - Maintenance
 - . Cleaning
 - . Winter protection

- o Central systems
 - Types and sizes
 - . Reciprocating
 - . Centrifugal
 - . Absorption
 - Function
 - . Components
 - Motors
 - Pumps
 - Drives
 - Controls
 - Inspection
 - . Visual
 - . Tests
 - Maintenance
 - . Repairs
 - . Adjustments
 - . Cleaning
 - . Lubrication

It is necessary that students possess a standing of the functioning of air condi

The student should be aware of the consi on cooling capacity of the nature of the structure, and the physical location of

The student should be able to install an unit conditioners in accordance with man instructions.

The student should be able to perform ro seasonal maintenance in accordance with cedural charts, and those repairs descri manufacturer's literature.

The student should be well grounded in t functional differences of the three type systems, and the relative advantages of

The student should be able to verbally of a representative system, identifying and describing their function and functi

The student should be able to perform a seasonal maintenance in accordance with cedural charts and manufacturer's instr

The students should be able to perform shooting and repair procedures authorize facturer and described in his literature

Note: Dual systems require maintenance — routine and seasonal — for both heating and cooling systems.

— COOLING SYSTEMS

- Room unit
 - Types and sizes
 - Cooling needs
 - Structure design factors
 - Installation
- Adjustments
 - Deflectors
 - Fan speed control
 - Vent/Cool controls
- Maintenance
 - Cleaning
 - Winter protection

It is necessary that students possess a basic understanding of the functioning of air conditioning units.

The student should be aware of the considerable effect on cooling capacity of the nature of the building, its structure, and the physical location of the unit itself.

The student should be able to install and adjust room unit conditioners in accordance with manufacturer's instructions.

The student should be able to perform routine and seasonal maintenance in accordance with provided procedural charts, and those repairs described in manufacturer's literature.

- Central systems
 - Types and sizes
 - Reciprocating
 - Centrifugal
 - Absorption
- Function
 - Components
 - Motors
 - Pumps
 - Drives
 - Controls
- Inspection
 - Visual
 - Tests
- Maintenance
 - Repairs
 - Adjustments
 - Cleaning
 - Lubrication

The student should be well grounded in the physical and functional differences of the three types of central systems, and the relative advantages of each.

The student should be able to verbally trace a schematic of a representative system, identifying component parts and describing their function and functioning.

The student should be able to perform all routine and seasonal maintenance in accordance with provided procedural charts and manufacturer's instructions.

The students should be able to perform the troubleshooting and repair procedures authorized by the manufacturer and described in his literature.

Dual systems require maintenance — routine and seasonal — for both heating and cooling systems.

DRAWINGS AND SPECIFICATIONS

Suggested Time: 15 Hours

UNIT I — DRAWINGS

TEACHING SUGGESTIONS

- Type
 - Architectural
 - . Plot plan
 - . Floor plan
 - . Elevation
 - . Section
 - . Detail
 - Mechanical/Electrical
 - . Pictorial
 - . Assembly
 - . Exploded
 - . Detail
 - . Schematic
- Interpretation
 - Notation
 - Symbols
 - Line weights
 - Measurement
 - . Stated
 - . Scaled

Instruction and practice should enable the student to identify a drawing by name and to state the characteristics which make it a distinct type.

The student must be able to correctly interpret a drawing if it is not necessary that he be able to make a drawing.

The student should be able to locate and interpret a teacher-specified point of information in a provided drawing.

UNIT II — SPECIFICATIONS

- Construction
 - Materials
 - Procedures
 - Standards of quality

Students should have an overall knowledge and breadth of information contained in specifications.

Emphasize that, where drawings and specifications agree, specifications take precedence.

DRAWINGS AND SPECIFICATIONS

Suggested Time: 15 Hours

UNIT I — DRAWINGS

TEACHING SUGGESTIONS

- Type
 - Architectural
 - . Plot plan
 - . Floor plan
 - . Elevation
 - . Section
 - . Detail
 - Mechanical/Electrical
 - . Pictorial
 - . Assembly
 - . Exploded
 - . Detail
 - . Schematic
- Interpretation
 - Notation
 - Symbols
 - Line weights
 - Measurement
 - . Stated
 - . Scaled

Instruction and practice should enable the student to identify a drawing by name and to state the characteristics which make it a distinct type.

The student must be able to correctly interpret drawings; it is not necessary that he be able to make drawings.

The student should be able to locate and interpret any teacher-specified point of information contained on a provided drawing.

UNIT II — SPECIFICATIONS

- Construction
 - Materials
 - Procedures
 - Standards of quality

Students should have an overall knowledge of the depth and breadth of information contained in specifications.

Emphasize that, where drawings and specifications do not agree, specifications take precedence.

- o Manufacturers'
 - Equipment
 - . Installation
 - . Maintenance
 - . Repair
 - Supplies
 - . Use
 - . Storage
 - Parts lists

The student should be able to locate and interpret any teacher-specified point of information contained in provided specifications.

It is not necessary that the student be able to write legally acceptable specifications. He should be able to write complete, clear, purchase orders.

BOOKKEEPING AND ESTIMATING

Suggested Time: 15 Hours

UNIT I — BASIC ACCOUNTING

TEACHING SUGGESTIONS

- Supplies inventory
- Equipment and plant maintenance
 - In-house
 - Contracted
- Insurance
 - Required by law
 - Optional
- Utilities
 - Fuels
 - Electricity
 - Water
 - Waste disposal
 - . Garbage
 - . Trash
 - . Sewerage
- Labor
 - Term
 - . Staff
 - . Ad hoc
 - Records
 - . Employment
 - Job interviews
 - Resumés
 - Proficiency credentials
 - Union memberships
 - Youth working papers
 - Terminations

Students should be capable of keeping a run of stock, of equipment, and of maintenance

Instruction should include familiarization required and optional, and with maintenance records.

Students should be aware of the need for co of utilities expenditures, for proof of pay estimating future expenditures, and for ope economy.

Students should be provided broad background of this aspect of supervision and management should be made aware of the legal ramifications employment and compensation records.

BOOKKEEPING AND ESTIMATING

Suggested Time: 15 Hours

— BASIC ACCOUNTING

TEACHING SUGGESTIONS

Supplies inventory	Students should be capable of keeping a running inventory of stock, of equipment, and of maintenance work performed.
Equipment and plant maintenance	
In-house	
Contracted	
Insurance	Instruction should include familiarization with coverages, required and optional, and with maintenance of necessary records.
Required by law	
Optional	
Utilities	Students should be aware of the need for complete records of utilities expenditures, for proof of payment, for estimating future expenditures, and for operational economy.
Fuels	
Electricity	
Water	
Waste disposal	
Garbage	
Trash	
Sewerage	
Labor	Students should be provided broad background knowledge of this aspect of supervision and management. They should be made aware of the legal ramifications of employment and compensation records.
Term	
Staff	
Ad hoc	
Records	
Employment	
Job interviews	
Resumes	
Proficiency credentials	
Union memberships	
Youth working papers	
Terminations	

Compensation
Payroll
Vacation
Sick leave
Accident reports

UNIT II — ESTIMATING

- Operational supplies
 - Custodial
 - Groundskeeping
 - Repair and maintenance
 - . Equipment
 - . Buildings
- Contingency supplies
 - Emergencies
 - Acts of nature
 - Unexpected crowds
- Labor
 - Staff
 - . Full-time
 - . Part-time
 - Subcontracted
- Utilities
 - Water
 - Power
 - . Fuels
 - . Electricity
 - Waste disposal
 - . Sewer taxes
 - . Garbage/trash collection

Instruction should include methods of needs.

Students should be capable of demonstrating estimating procedure, basing figures on previous expenditures. Greater accuracy is expected in estimating supplies than at the entry-level correct procedure, but at the entry-level correct procedure is more important than resulting figures.

Compensation

Payroll

Vacation

Sick leave

Accident reports

II — ESTIMATING

Operational supplies

- Custodial
- Groundskeeping
- Repair and maintenance
 - . Equipment
 - . Buildings

Contingency supplies

- Emergencies
- Acts of nature
- Unexpected crowds

Labor

- Staff
 - . Full-time
 - . Part-time
- Subcontracted

Utilities

- Water
- Power
 - . Fuels
 - . Electricity
- Waste disposal
 - . Sewer taxes
 - . Garbage/trash collection

Instruction should include methods of estimating future needs.

Students should be capable of demonstrating good estimating procedure, basing figures on provided records of previous expenditures. Greater accuracy should be expected in estimating supplies than in labor time/costs, but at the entry-level correct procedure is more important than resulting figures.

RESOURCE LIST

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Boring and drilling tools. 10 min. b&w.
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SLIDES — 35mm.

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DCA Educational Products

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Universal Publishing and Distributing Corp.
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SUGGESTED EQUIPMENT

A suggested minimum inventory considered necessary to successful presentation of this program in vocational education, this list was compiled on a basis of 20 students per class group.

While durability, effectiveness, cost, ease-of-use, and inherent safety of the various makes of a given item should be carefully considered in order to obtain *the best*, it must be remembered that no one type should be exposed to different makes and models of essentially equal desirability rather than expose one type which is preferred by the selecting authority.

HAND TOOLS

2	Caliper; inside	2	Saw; rip, 5 1/2 ft., straight
2	Caliper; outside	2	Saw; back, 13 ft.
1	Micrometer; 0" to 1"	6	Saw; coping, 6 1/2" depth
2	Tape measure; 12'	2	Saw; compass, 3/4" to 1 1/4"
1	Tape measure; 50'	1 ea.	Saw; hole, 1 3/8", 1 3/4"
1	Tape measure; 100'	6	Saw; hack, Diston #368, 6"
24	Rule; zig-zag, 6'	6	Plane; smooth, Stanley #3
6	Chalk box; 50'	3	Plane; jack, Stanley #5, 3"
1	Protractor	2	Plane; jointer, Stanley #1
2	Wing divider; 6"	3	Plane; block
	w/interchangeable lead/point	2 sets	Chisel; wood, Stanley #66
20	Scriber; w/pencil	2	Chisel; 2" butt, Stanley
6	Scratch awl	2 sets	Cold chisel
4	Square; framing	3	Cutter; pipe, 3" cap.
4	Square; combination	3	Cutter; tubing, 1 1/2" cap.
6	Square; try, 8"	12	Cutter; glass
3	Square; T, drywall	2 sets	Bit; screwdriver, 5/16" to 3/8"
2	Sliding T bevel; 8"	3	Bit; expansive, 7/8" to 3"
2	Gage; butt	2 sets	Bit; spade, 3/8" to 1"
1	Gage; wire	2 sets	Bit; auger, 1/4" to 1"
4	Snips; 3 1/2" cut	2 sets	Bit; masonry, carbide, 1"
4	Snips; curved, 3" cut	2 sets	Twist drill; high speed, 1/2"
4	Snips; aviation, combination	1	Screwdriving attachment; Versamatic #4100, or equivalent
12	Knife; utility		
3	Shears; shrub	10	Hammer; rip claw, steel
3	Shears; pruning	5	Hammer; curved claw, steel
6	Saw; crosscut, 8 ft., straightback	5	Hammer; rip claw, steel
6	Saw; crosscut, 11 ft., straightback	4	Hammer; ball pein, 16 oz.

SUGGESTED EQUIPMENT*

minimum inventory considered necessary to successful presentation of this program of occupational list was compiled on a basis of 20 students per class group.

quality, effectiveness, cost, ease-of-use, and inherent safety of the various makes and models of tools should be carefully considered in order to obtain *the best*, it must be remembered that students should be exposed to different makes and models of essentially equal desirability rather than experience only that which is preferred by the selecting authority.

HAND TOOLS

Caliper; inside	2	Saw; rip, 5 1/2 pt., straightback
Caliper; outside	2	Saw; back, 13 pt.
Protractor; 0" to 1"	6	Saw; coping, 6 1/2" depth
Rope measure; 12'	2	Saw; compass, 3/asst'd blades
Rope measure; 50'	1 ea.	Saw; hole, 1 3/8", 1 3/4", 2", 2 1/4"
Rope measure; 100'	6	Saw; hack, Diston #368, or equiv.
Ruler; zig-zag, 6'	6	Plane; smooth, Stanley #3, or equiv.
Shalk box; 50'	3	Plane; jack, Stanley #5, or equiv.
Snout tractor	2	Plane; jointer, Stanley #7, or equiv.
String divider; 6"	3	Plane; block
Wrench; interchangeable lead/point	2 sets	Chisel; wood, Stanley #66, or equiv.
Scriber; w/pencil	2	Chisel; 2" butt, Stanley #60, or equiv.
Scratch awl	2 sets	Cold chisel
Square; framing	3	Cutter; pipe, 3" cap.
Square; combination	3	Cutter; tubing, 1 1/2" cap.
Square; try, 8"	12	Cutter; glass
Square; T, drywall	2 sets	Bit; screwdriver, 5/16" to 1/2"
Sliding T bevel; 8"	3	Bit; expansive, 7/8" to 3"
Wrench; butt	2 sets	Bit; spade, 3/8" to 1"
Wrench; wire	2 sets	Bit; auger, 1/4" to 1"
Wrench; 3 1/2" cut	2 sets	Bit; masonry, carbide, 1/4" to 3/4"
Wrench; curved, 3" cut	2 sets	Twist drill; high speed, 1/16" to 1/2"
Wrench; aviation, combination	1	Screwdriving attachment; Supreme
Knife; utility		Versamatic #4100, or equiv.
Shears; shrub	10	Hammer; rip claw, steel shank, 16 oz.
Shears; pruning	5	Hammer; curved claw, steel shank, 16 oz.
Saw; crosscut, 8 pt., straightback	5	Hammer; rip claw, steel shank, 20 oz.
Saw; crosscut, 11 pt., straightback	4	Hammer; ball peir, 16 oz.

4 Hammer; ball pein, 12 oz.
 1 Hammer; sledge, 8 lb.
 2 Hammer; plastic face, 8 oz.
 6 Hammer; bricklayer's
 4 Mallet; hickory
 2 Mallet; hard rubber
 10 Pliers; sidecut, 8"
 6 Pliers; diagonal, 7"
 2 Pliers; end cut, 8"
 6 Pliers; utility, 6"
 6 Pliers; vise-grip
 6 Pliers; needle-nose, 6"
 2 sets Wrench; Allen
 1 set Wrench; box
 1 set Wrench; socket, 1/4" drive
 1 set Wrench; socket, 3/8" drive
 1 set Wrench; open end
 1 Wrench; pipe, 10"
 1 Wrench; pipe, 14"
 1 Wrench; pipe, 18"
 4 Wrench; adjustable, 4"
 4 Wrench; adjustable, 6"
 4 Wrench; adjustable, 8"
 1 Wrench; adjustable, 10"
 1 Wrench; adjustable, 12"
 1 set Wrench; flat, 1/4" to 11/16"
 2 Wrench; spark plug
 1 Wrench; monkey, 10"
 1 Wrench; monkey, 15"
 10 Handscraper
 3 Countersink; brace
 3 Countersink; power
 1 ea. Reamer; brace, power
 6 Push drill; Yankee 41Y, or equiv.
 4 Brace; ratchet, 12" swing
 3 Screwdriver; ratchet, Yankee #30A,
 or equiv.
 3 sets Screwdriver; Irwin #400-M7, or equiv.
 12 Knife; putty
 12 Knife; spackling

6 Knife; electrician's
 12 Cable rip
 6 Wire stripper
 4 Fuse puller
 12 Tester; neon
 4 Crimping tool
 2 Bar; wrecking, 30"
 6 Catspaw
 24 Nailset; assorted
 1 set Punch; pin
 6 File; mill, bastard cut, 10"
 4 File; mill, 2d cut, 10"
 4 File; traingular, slip tape
 12 Rasp; assorted
 24 Handle; file
 6 File card
 6 Spirit level; 24", Stanley
 6 Spirit level; 48", magnes
 1 Spirit level; 72", magnes
 6 Plumb bob
 6 Jointer; bricklayer's
 6 Trowel; brick
 6 Trowel; pointing
 6 Trowel; concrete finishing
 6 Trowel; plasterer's
 6 Float; wood
 3 Float; cork faced
 3 Float; sponge rubber
 1 Parby; plasterer's
 6 Hawk; plasterer's
 3 Edger; concrete finishing
 3 Groover; concrete finishin
 3 Rubbing brick
 4 Caulking gun; cartridge
 6 ea. Brush; paint and varnish,
 3", 4"
 6 sets Roller & Pan; assorted cov
 1 unit Roller; pressurized

hammer; ball pein, 12 oz.	6	Knife; electrician's
hammer; sledge, 8 lb.	12	Cable rip
hammer; plastic face, 8 oz.	6	Wire stripper
hammer; bricklayer's	4	Fuse puller
mallet; hickory	12	Tester; neon
mallet; hard rubber	4	Crimping tool
pliers; sidecut, 8"	2	Bar; wrecking, 30"
pliers; diagonal, 7"	6	Catspaw
pliers; end cut, 8"	24	Nailset; assorted
pliers; utility, 6"	1 set	Punch; pin
pliers; vise-grip	6	File; mill, bastard cut, 10"
pliers; needle-nose, 6"	4	File; mill, 2d cut, 10"
wrench; Allen	4	File; traingular, slip taper, 6"
wrench; box	12	Rasp; assorted
wrench; socket, 1/4" drive	24	Handle; file
wrench; socket, 3/8" drive	6	File card
wrench; open end	6	Spirit level; 24", Stanley #313, or equiv.
wrench; pipe, 10"	6	Spirit level; 48", magnesium alloy
wrench; pipe, 14"	1	Spirit level; 72", magnesium alloy
wrench; pipe, 18"	6	Plumb bob
wrench; adjustable, 4"	6	Jointer; bricklayer's
wrench; adjustable, 6"	6	Trowel; brick
wrench; adjustable, 8"	6	Trowel; pointing
wrench; adjustable, 10"	6	Trowel; concrete finishing
wrench; adjustable, 12"	6	Trowel; plasterer's
wrench; flat, 1/4" to 11/16"	6	Float; wood
wrench; spark plug	3	Float; cork faced
wrench; monkey, 10"	3	Float; sponge rubber
wrench; monkey, 15"	1	Darby; plasterer's
handscrapper	6	Hawk; plasterer's
countersink; brace	3	Edger; concrete finishing
countersink; power	3	Groover; concrete finishing
reamer; brace, power	3	Rubbing brick
push drill; Yankee 41Y, or equiv.	4	Caulking gun; cartridge
brace; ratchet, 12" swing	6 ea.	Brush; paint and varnish, 1/2", 1", 2", 3", 4"
screwdriver; ratchet, Yankee #30A, or equiv.	6 sets	Roller & Pan; assorted covers
screwdriver; Irwin #400-M7, or equiv.	1 unit	Roller; pressurized
knife; putty		
knife; spackling		

GENERAL EQUIPMENT

4	Workbench, 4-place; steel locker base, hardwood top; w/2 rapid-acting 10" woodworking vises (Equiv. 2-place benches may be substituted).	3	Extension cord; heavy
2	Workbench; standard metalworking, 6'	100 ft.	Hose; water, 3/4", rub
1	Bench; glue and stain	1	Mortar box
2	Cabinet; hardware	6	Mortar pan
3	Bin; parts	10	Mortar board
2	Flaring tool; ROL-AIR #500-FA, or equiv.	1	Tamper; jitterbug
1	Pipe threader; Ridgid #111-R, or equiv.	1	Hoe; mortar
1	Tubing bender; 1/4" to 5/8" O.D.	1	Shovel; square point,
1	Vise; pipe, 2" cap.	3	Shovel; pointed, 60"
4	Vise; machinist's, 4" jaw	1	Shovel; pointed, 27"
3	Vise; utility, 5" cap.	1	Post hole digger
1	Vise; jeweler's	1	Crowbar; 60"
1	Saw clamp; Diston #2, or equiv.	6	Rake; lawn
1	Saw set; Diston #24, or equiv.	6	Rake; grading
2 sets	Tap and die	6	Broom; floor, 18"
2 sets	Screw extractor	3	Broom; floor, heavy d
1 set	Wheel puller		#550, or equiv.
1	Arbor press; w/pedestal; Dake #0, or larger.	6	Counter duster; utili
12 ea.	Clamp; "C", 2", 4", 6"	6	Dust mop
6	Clamp; bar, 5'	4	Pail and wringer doll
4	Clamp; double bar, 5'	2	Dolly; Waber #LOW-5,
12	Handscrew; Jorgenson #1, or equiv.	2	Hand truck; steel, w/
1	Miterbox, w/saw; Stanley #358, or equiv.	4	Ladder; step, 8'
1	Cutter; ceramic tile	6	Ladder; step, 6'
2 kits	Staple gun; Arrow T-50 MP, or equiv.	4	Ladder; step, 4'
6 kits	Propane torch; Bernzomatic TX-25, or equiv.	1	Ladder; extension, wo
2	"Pop" riveter	3 sets	Wall papering kit
1	Oilstone; Norton Multi-Oilstone, or equiv.	1	Oily Waste Can; Eagle
2	Oilstone; silicon carbide, course/fine; 8" x 2" x 1"	1	Safety Waste Can; ASI
3	Oiler; pump; Eagle #33F, or equiv.	6	Respirator; replaceab
3 ea.	Oiler; bench, Eagle #3004, #3006, or equiv.	6	Pouch; electrician's
		6	Face shield
		24	Safety glasses

GENERAL EQUIPMENT

Workbench, 4-place; steel locker base, hardwood top; w/2 rapid-acting 10" woodworking vises (Equiv. 2-place benches may be substituted)	3	Extension cord; heavy duty, 3-wire, 50'
Workbench; standard metalworking, 6'	100 ft.	Hose; water, 3/4", rubber
Bench; glue and stain	1	Mortar box
Cabinet; hardware	6	Mortar pan
Bin; parts	10	Mortar board
Flaring tool; ROL-AIR #500-FA, or equiv.	1	Tamper; jitterbug
Pipe threader; Ridgid #111-R, or equiv.	1	Hoe; mortar
Tubing bender; 1/4" to 5/8" O.D.	1	Shovel; square point, 27" D handle
Vise; pipe, 2" cap.	3	Shovel; pointed, 60" straight handle
Vise; machinist's, 4" jaw	1	Shovel; pointed, 27" D handle
Vise; utility, 5" cap.	1	Post hole digger
Vise; jeweler's	1	Crowbar; 60"
Saw clamp; Diston #2, or equiv.	6	Rake; lawn
Saw set; Diston #24, or equiv.	6	Rake; grading
sets Tap and die	6	Broom; floor, 18"
sets Screw extractor	3	Broom; floor, heavy duty, 24"; Monarch #550, or equiv.
set Wheel puller	6	Counter duster; utility
Arbor press; w/pedestal; Dake #0, or larger.	6	Dust mop
ea. Clamp; "C", 2", 4", 6"	4	Pail and wringer dolly; w/mop
Clamp; bar, 5'	2	Dolly; Waber #LOW-5, or equiv.
Clamp; double bar, 5'	2	Hand truck; steel, w/ratchet strap
Handscrew; Jorgenson #1, or equiv.	4	Ladder; step, 8'
Miterbox, w/saw; Stanley #358, or equiv.	6	Ladder; step, 6'
Cutter; ceramic tile	4	Ladder; step, 4'
kits Staple gun; Arrow T-50 MP, or equiv.	1	Ladder; extension, wood, 32'
kits Propane torch; Bernzomatic TX-25, or equiv.	3 sets	Wall papering kit
"Pop" riveter	1	Oily Waste Can; Eagle #910FL, or equiv.
Oilstone; Norton Multi-Oilstone, or equiv.	1	Safety Waste Can; ASI equivalent
Oilstone; silicon carbide, course/fine; 8" x 2" x 1"	6	Respirator; replaceable filter
Oiler; pump; Eagle #33F, or equiv.	6	Pouch; electrician's
ea. Oiler; bench, Eagle #3004, #3006, or equiv.	6	Face shield
	24	Safety glasses

POWER TOOLS

1	Drill press; floor model, 15" cap., step-pulley or split-pulley speed control, 3/4 H.P., key chuck, tilting table	1	Engine; gasoline, 2 cycle,
1	Vise; drill press	1	Lawn mower; gasoline, reel
1	Vise; drill press, float lock	1	Lawn mower; gasoline, rota
1	Grinder; 7" pedestal model w/shields, tool rests, blade grinding attachment, assorted wheels, and wheel dresser, 1/2 H.P.	1	Snow blower; gasoline, 2-s
1	Saw; radial arm, 10" floor model w/accessories, assorted blades, and dado head set, 2 H.P.	1	Compressor; portable elect
1	Saw; scroll, 24" floor model, 1/3 H.P. variable speed		air guns, and accessories or equiv.
1	Saw; portable electric, Porter-Cable #597, or equiv.	1	Buffer; pedestal, long-sha
2	Saw; saber, heavy duty, adjustable base plate		buffing wheels and wire
1	Drill; portable electric, 1/4" cap., Porter-Cable #355, or equiv.	1 set	Welding and cutting equipm
2	Drill; portable electric, 3/8" cap., variable speed, Black & Decker #1170, or equiv.		GW2-0-43, or equiv.
1	Drill; portable electric, 1/2" cap., reversible, Stanley #127, or equiv.	1	Spot welding gun; REDI-SPQ
2	Sander; belt, Skil #449, or equiv.	4	Soldering iron; 25w. to 55
2	Sander; finishing, Skil #692, or equiv.	4	Soldering gun; 25w. to 450
1	Router; 1/4" shaft, w/guides, cutter assortment, and plastic laminate trimmer	1	Sanitizing cabinet, for sa
1	Vacuum; Clarke M400, or equiv.		respirators
2	Vacuum; wet or dry, heavy duty, w/accessories		
2	Floor maintainers; heavy duty, w/stripping and buffing pads		
1	Hammer; impact, electric		

POWER TOOLS

Drill press; floor model, 15" cap., step-pulley or split-pulley speed control, 3/4 H.P., key chuck, tilting table	1	Engine; gasoline, 2 cycle, 2 1/2 H.P.
Drill press	1	Lawn mower; gasoline, reel
Drill press, float lock	1	Lawn mower; gasoline, rotary, self-propelled
Grinder; 7" pedestal model w/shields, tool rests, blade grinding attachment, assorted wheels, and wheel dresser, 1/2 H.P.	1	Snow blower; gasoline, 2-stage
Saw; radial arm, 10" floor model w/accessories, assorted blades, and dado head set, 2 H.P.	1	Compressor; portable electric/ w/spray guns, air guns, and accessories, Sprayit, #3040, or equiv.
Saw; scroll, 24" floor model, 1/3 H.P. variable speed	1	Buffer; pedestal, long-shaft model, w/8" buffing wheels and wire brushes
Saw; portable electric, Porter-Cable #597, or equiv.	1 set	Welding and cutting equipment, Marquette GW2-0-43, or equiv.
Saw; saber, heavy duty, adjustable base plate	1	Spot welding gun; REDI-SPOT #21A24, or equiv.
Drill; portable electric, 1/4" cap., Porter-Cable #355, or equiv.	4	Soldering iron; 25w. to 550w.
Drill; portable electric, 3/8" cap., variable speed, Black & Decker #1170, or equiv.	4	Soldering gun; 25w. to 450w.
Drill; portable electric, 1/2" cap., reversible, Stanley #127, or equiv.	1	Sanitizing cabinet, for safety glasses and respirators
Sander; belt, Skil #449, or equiv.		
Sander; finishing, Skil #692, or equiv.		
Router; 1/4" shaft, w/guides, cutter assortment, and plastic laminate trimmer		
Vacuum; Clarke M400, or equiv.		
Vacuum; wet or dry, heavy duty, w/accessories		
Floor maintainers; heavy duty, w/stripping and buffing pads		
Hammer; impact, electric		